Appendix 7

Technical Report: Response to Comments on Flow Requirements for the Yuba River Downstream of Englebright Dam (YCWA Proposed Condition AR3)
(HDR Engineering, Inc. and Stephen Grinnell, P.E.)

Response to Comments on Flow Requirements for the Yuba River Downstream of Englebright Dam (YCWA Proposed Condition AR3)

Yuba River Development Project
FERC Project No. 2246

Prepared by HDR Engineering, Inc. & Stephen Grinnell, P.E.

October 9, 2017

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The Yuba County Water Agency (YCWA or Licensee), licensee for the Yuba River Development Project (YRDP), Federal Energy Regulatory Commission (FERC) Project No. 2246 (Project), has prepared this document to address the comments, recommendations, and preliminary terms and conditions filed in response to YCWA's proposed condition AR3 – Maintain Minimum Streamflows at Narrows 2 Powerhouse and Narrows 2 Full Bypass, which is part of YCWA's Final License Application that was filed with the FERC on April 21, 2014, as amended on June 5, 2017.

At the request of YCWA, HDR Engineering, Inc. (HDR) and Stephen Grinnell, P.E. have prepared this technical report.

1. YCWA Proposed Condition AR3, Maintain Minimum Streamflows at Narrows 2 Powerhouse and Narrows 2 Full Bypass

YCWA included in its Amended Final License Application (AFLA) proposed condition AR3. This condition would require YCWA to meet the minimum streamflows in the Yuba River shown in Table 1 of this condition (see Section E2.4.3 of Appendix E2 of Exhibit E of the AFLA).

1.1 Development of Yuba Accord Lower Yuba River Flow Schedules

As discussed in this report, representatives of YCWA, the California Department of Fish and Wildlife (CDFW), National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS), United States Department of the Interior (USDOI), Fish and Wildlife Service (FWS or USFWS), and several non-governmental organizations (NGOs) met from 2002 through 2005, and negotiated a set of minimum flow requirements (flow schedules) for the Yuba River downstream of Englebright Dam (lower Yuba River). These parties carefully considered the water supplies that will be available in different types of water years, ranked the stressors in the lower Yuba River that apply to each species or run of salmonids, and considered all relevant biological factors as they developed these flow schedules. These flows schedules then were included in the Yuba Accord Fisheries Agreement and YCWA's water-right licenses, and YCWA now operates the Project to maintain these minimum flows. YCWA's Proposed Condition AR3 would amend YCWA's FERC license to incorporate these flow schedules, with no changes for Schedule 1 through 6 Water years and some minor amendments to the schedules for Conference Years (discussed below).

During 2005 through 2007, YCWA conducted a comprehensive California Environmental Quality Act (CEQA) / National Environmental Policy Act (NEPA) process to analyze the environmental effects of the Yuba Accord, and in late 2007 YCWA certified its final Environmental Impact Report (EIR) for the Yuba Accord. On May 20, 2008, the SWRCB adopted its Corrected Order Water Rights (WR) 2008-0014, which amended YCWA's water right permits to incorporate the Yuba Accord flow schedules.

CDFW, FWS and the Foothills Water Network (FWN) now are asking FERC to change YCWA's Proposed Condition AR3 in several ways that would upset the careful balance that was made when the Yuba Accord flow schedules were developed.

1.2 YCWA's Proposed Changes in Conference Year Schedules

For Schedule 1 through Schedule 6 years, the proposed minimum streamflows in Table 1 of YCWA's proposed condition are the same as the corresponding minimum instream flow requirements in the Yuba Accord's Fisheries Agreement, as ordered by the SWRCB in its Corrected Order WR 2008-0014 on pages 56-57 in term 1 (See also, SWRCB Corrected Order WR 2008-0014, fig. 2.). For Conference Years, there are some differences between YCWA's proposed condition and the corresponding requirements in Corrected Order WR 2008-0014 (See SWRCB Corrected Order WR 2008-0014, pg. 57 and fig. 7). These differences are shown in Table E2-5 of Appendix E2 of Exhibit E of the AFLA, and the reasons for them and effects of the changes are discussed in the following paragraphs.

If implemented, the proposed new Conference Year requirements will have some significant benefits over the current Conference Year requirements. First, the proposed new requirements at the United States Geological Survey (USGS) Smartsville gage will be in effect for an additional 45 days during September and the first part of October, and for an additional 15 days during the first part of April. In addition, there will be fewer month-to-month changes in these requirements. At the USGS Marysville gage, the proposed new requirements will be constant from October 1 through March 31, while the current requirements have substantial reductions beginning on January 1. The potential for de-watering of Chinook salmon redds has been studied by YCWA and the Yuba Accord River Management Team (RMT) during the past 7 years. As a result of these studies, YCWA believes that the proposed, more-constant Conference Year flow requirements for the September through March timeframe (which is the spawning and incubation period for Chinook salmon in the Yuba River) will result in less potential for de-watering of the redds of these salmon than would occur under the current, Yuba Accord Conference Year flow schedules. These new flow schedules also will require an approximately 14 percent increase in the total volume of water that must flow past the Marysville gage in Conference Years during the November through March period.

For the July through September period of Conference Years, YCWA's proposed condition AR3 would increase the minimum flows at the Marysville gage from 70 to 150 cubic feet per second (cfs). These higher flows will require an additional 14,598 acre-feet (ac-ft) of water to pass the Marysville gage during these months in Conference Years, approximately a 114 percent increase for this period. YCWA believes that these higher minimum flows will provide better water

temperature conditions in the Yuba River than would occur during Conference Years under the current requirements.

If these changes are made, then the total volume of water that will be required to flow past the Marysville gage during Conference Years will increase from the 174,208 ac-ft required to meet the Yuba Accord Conference Year requirements to a new total of 197,445 ac-ft.

YCWA estimates that the cost to implement its condition is $360,000 over 30 years (i.e., $12,000/yr). Refer to Table 4.3-2 of Exhibit E for YCWA's cost estimate and rationale for the cost estimate.

1.3 Biological Basis and Support for YCWA Condition AR3

The Yuba Accord flows, which are the current lower Yuba River minimum flow requirements and form the basis for the proposed lower Yuba River minimum flow requirements in proposed Condition AR3 of YCWA's AFLA, were developed through a rigorous and collaborative scientific process examining environmental flow requirements of lower Yuba River salmonids by species, lifestage and location. From 2002 through 2005, representatives of YCWA, CDFW, NMFS, FWS, and several NGOs collaborated on a set of minimum flow requirements (flow schedules) for the Yuba River downstream of the United States Army Corps of Engineers' (USACE) Englebright Dam.

The SWRCB, on May 20, 2008, revised YCWA's water rights in Corrected Order 2008-0014 to implement the new lower Yuba River flow requirements to address fisheries protection and water right issues involving YCWA's diversion and use of water from the Yuba River. As stated in section 5.2 of the Corrected Order, the comprehensive EIR/ Environmental Impact Statement (EIS) considered the overall impact of each affected fish species. For each fishery, the EIR/EIS considered each run, each lifestage and each month corresponding to specific lifestages across the full range of Yuba River hydrologic conditions.

The current flow requirements were developed to achieve the following objectives (RMT 2010, 2013):

- Maximize the occurrence of "optimal" flows and minimize the occurrence of sub-optimal flows, within the bounds of hydrologic variation and available water storage capacity
- Maximize the occurrence of appropriate flows for Chinook salmon (*Oncorhynchus tshawytscha*) and Central Valley steelhead (*O. mykiss*) immigration, spawning, rearing, and emigration
- Provide month-to-month flow sequencing in consideration of Chinook salmon and steelhead life history periodicities
- Provide appropriate water temperatures for Chinook salmon and steelhead immigration and holding, spawning, embryo incubation, rearing and emigration
- Promote a dynamic, resilient, and diverse fish assemblage

- Minimize potential stressors to fish species and lifestages
- Develop flow regimes that consider all freshwater lifestages of salmonids and allocate flows accordingly

The Yuba Accord Fisheries Agreement, which was executed by YCWA, CDFW and four NGO's, and supported by NMFS and FWS, contains the following language:

> The Parties intend that their monitoring and data-collection actions will produce a useful database for the proceedings of the Federal Energy Regulatory Commission regarding the relicensing of YCWA's FERC License for the Yuba Project, which expires in 2016. The Parties also intend that this monitoring and data-collection be used to evaluate the biological provisions of this Agreement.

In 2006, pursuant to the Yuba Accord Fisheries Agreement, YCWA established a RMT. The RMT's primary role is to conduct a program of monitoring and evaluation studies to assess the conditions of the fisheries in the lower Yuba River. In addition to YCWA, the RMT includes representatives of CDFW, NMFS, FWS, California Department of Water Resources (DWR), Friends of the River, The Bay Institute, the South Yuba River Citizens League, Trout Unlimited and other stakeholders. The RMT's Monitoring and Evaluation (M&E) program was designed to evaluate: 1) the effectiveness of the implementation of the updated flow schedules in protecting anadromous salmonids; 2) the condition of fish resources in the lower Yuba River; and 3) the viability of lower Yuba River fall-run Chinook salmon, and any subpopulations of the Central Valley steelhead distinct population segment (DPS) and spring-run Chinook salmon evolutionarily significant unit (ESU) that may exist in the lower Yuba River. YCWA has provided funding in excess of $550,000 annually since 2006 for the RMT's science program.

The RMT science program has been augmented by scientific analyses conducted for FERC relicensing of the Yuba River Development Project. The result of these extensive studies and evaluations has led YCWA to propose that FERC include the Yuba Accord minimum instream flow requirements for the lower Yuba River, with the revisions to the Conference Year minimum flow requirements discussed above, in YCWA's new license (see Appendix E2 of Exhibit E of the AFLA, section E2.4.3). These proposed requirements, which were developed using rigorous, collaborative and contemporary science, are based on the best available scientific information and will provide functional flow regimes for anadromous salmonids in the lower Yuba River.

1.4 Commenters' Recommended Changes to AR3 - Maintain Minimum Streamflows Downstream of Narrows 2 Powerhouse and Narrows 2 Full Bypass

CDFW, FWS, USDOI, Bureau of Land Management (BLM), NMFS, SWRCB and Foothills Water Network (FWN) each have recommended a condition based on YCWA's proposed condition AR3, but with several proposed changes to the minimum instream flow requirements for certain periods of various water years. These agency recommendations are discussed in the following subsections.

CDFW[1] PROPOSED CONDITION 2.5

The CDFW's Federal Power Act (FPA) Section 10(j) recommended Condition 2.5 (Maintain Minimum Streamflows Downstream of Narrows 2 Powerhouse and Narrows 2 Full Bypass) proposes several changes to the minimum flow requirements in YCWA's proposed Condition AR3.

CDFW's proposed changes are shown in the following paragraphs in redline/strikeout format. The flows in YCWA's proposed AFLA are shown as strikeout where CDFW proposed a different flow, and those occasions are highlighted in CDFW's Table 2.5-1, shown below.

Licensee, in coordinated operations with the license ~~licensee~~ for the Narrows Project (FERC Project No. 1403) under the coordinated operations agreement or Commission order described in Licensee's proposed GEN4 (CDFW Recommended Condition 2.8 of this Enclosure A),~~GEN4,~~ shall meet the minimum streamflows in the Yuba River shown in Table 2.5-1 of this condition. These streamflows shall be measured at the indicated USGS gages, which are located downstream of the combined releases of the Narrows Project, the Narrows 2 Powerhouse and the Narrows 2 Full Bypass. License ~~Licensee~~ shall record minimum streamflow at all gages as required by USGS (Article 8 of FERC's Form L-5, Standard Articles).

Table 2.5-1. Minimum Streamflows in cubic feet per second (cfs) for the Yuba River Development Project by date ~~month~~ and Water Year Type. Water Types pertaining to Narrows 2 Powerhouse and Narrows 2 Full Bypass are provided, ~~which is defined~~ in CDFW Recommended ~~Licensee's Proposed~~ Condition 2.2 of this Enclosure A~~WR3~~.

Month	Schedule 1	Schedule 2	Schedule 3	Schedule 4	Schedule 5	Schedule 6	Conference Year
YUBA RIVER - BELOW NARROWS 2 POWERHOUSE/NARROWS 2 FULL BYPASS (COMPLIANCE POINT: SMARTSVILLE - USGS STREAMFLOW GAGE 11418000)							
October 1 – 15	700	700	700	700	600	600	500
October 16 – 31	700	700	700	700	600	600	500
November 1 – 30	700	700	700	700	600	600	500
December 1 – 31	700	700	700	700	550	550	500
January 1 – 15	700	700	700	700	550	550	500
January 16 – 31	700	700	700	700	550	550	500
February 1 – 29	700	700	700	700	550[1]	550[1]	500[1]
March 1 – 31	700	700	700	700	550	550	500
April 1 – 15	700	700	700	700	600	600	500
April 16 – 30	--	--	--	--	--	--	--
May 1 – 15	--	--	--	--	--	--	--
May 16 – 31	--	--	--	--	--	--	--
June 1 – 15	--	--	--	--	--	--	--
June 16 – 30	--	--	--	--	--	--	--
July 1 – 31	--	--	--	--	--	--	--
August 1 – 31	--	--	--	--	--	--	--
September 1 – 30	700	700	700	700	500	500	500
YUBA RIVER - BELOW NARROWS 2 POWERHOUSE/NARROWS 2 FULL BYPASS (COMPLIANCE POINT: MARYSVILLE - USGS STREAMFLOW GAGE 11421000)							
October 1 – 15	500	500	500	400	400	350	350
October 16 – 31	500	500	500	400	400	350	350

[1] In their recommended revisions to AR3, CDFW changed the reference to their organization to "CDFW", rather than Cal Fish and Wildlife. The CDFW nomenclature is therefore used in the remainder of this response to comments.

Table 2.5-1. (continued)

November 1 – 30	500	500	500	500	500	350	350
December 1 – 31	500	500	500	500	500	350	350
January 1 – 15	500	500	500	500	500	350	350
January 16 – 31	500	500	500	500	500	350	350
February 1 – 29	500	500	500	500	500	350	350
March 1 – ~~31~~22	700	700	500	500	500	350	350
March 23 – 31	~~700~~ 3,500[2]	700	500	500	500	350	350
April 1 – 15	~~1,000~~ 3,500[2]	~~700~~ 2,500	~~700~~ 900	600	500	350	300
April 16 – 30	~~1,000~~ 3,500[2]	~~800~~ 2,500	~~700~~ 900	900	600	500	~~245~~ 300
May 1 – 15	2,000	~~1,000~~ 1,400	~~900~~ 1,150	900	~~600~~ 850	~~500~~ 750	~~245~~ 395
May 16 – 31	2,000	1,000	900	600	400	400	~~245~~ 300
June 1 – 15	1,500	800	500	400	400	300	245
June 16 – 30	1,500	500	500	400	400	150	150
July 1 – 31	700	500	500	400	400	150	150
August 1 – 31	600	500	500	400	400	150	150
September 1 – 30	500	500	500	400	400	350	150

[1] See Winter Pulse Flows section and conditional winter pulse flow requirement in Table 2.5.2 below.

[2] Because diversions at Daguerre Point Dam are not controlled by Licensee, Licensee will be considered to be in compliance with the specified minimum instream flows when the combined release from the Narrows 1 Powerhouse (FERC Project No. 1403) and Narrows 2 Facilities, as measured at the Smartsville - USGS Streamflows Gage 11421000 is at or above 4,120 cfs (the combined capacity of Narrows 1 Powerhouse and Narrows 2 Facilities) and Englebright Dam is not spilling.

Minimum streamflows in this condition shall mean the 5-day running average of average daily streamflows, with the 15-minute flows not less than 90 percent of the specified flow requirement in Table 2.5-1 of this condition. In addition, 15-minute flows shall not be less than the applicable flow requirement specified in Table 2.5-1 for more than 48 consecutive hours.

Minimum streamflows in this condition may be temporarily modified for short periods, as necessary for powerhouse outages required for inspections and maintenance purposes, upon approval of the Commission.

Minimum streamflows may be temporarily modified due to an emergency. An emergency is defined as an outage due to an event that is reasonably out of the control of Licensee and requires Licensee to take immediate action, either unilaterally or under instruction of law enforcement, emergency services, California ISO or other regulatory agency staff, including actions to prevent or reduce the imminent loss of human life or damage to property. An emergency may include, but is not limited to: natural events such as earthquakes, landslides, storms, or wildfires; vandalism; malfunction or failure of transmission lines or Project works; or other public safety incidents. If Licensee temporarily modifies the requirements of this condition due to an emergency, Licensee shall make all reasonable efforts to promptly resume performance of the requirements, and shall notify the NMFS, FWS, CDFW,~~Cal Fish and Wildlife~~ and the SWRCB within 48 hours of the start of the modification. Licensee shall provide notification to the Commission as soon as possible but no later than 10 days after such incident.

If any of the minimum flow requirements in YCWA's water right permits are temporarily modified by the SWRCB or its Deputy Director for Water Rights, and if Licensee, NMFS, FWS and CDFW,~~Cal Fish and Wildlife~~ agree, then Licensee may make corresponding temporary modifications to the requirements in this condition. Licensee shall provide notification to the

Commission as soon as possible but no later than 10 days after such temporary modifications are made.

Winter Pulse Flows

If between December 1 and February 1 in Schedule 5, 6, and Conference WYs there are no instances in which for two consecutive days flows are greater than 3,000 cfs as measured at the Smartsville – USGS Streamflow Gage 11418000, Licensee shall implement conditional winter pulse flows as follows:

Table 2.5-2. Conditional Winter Pulse Flows in cfs for the Yuba River Development Project by date and WY Type (see CDFW Recommended Condition 2.2 of this Enclosure A) required to be implemented in Schedule 5, 6, and Conference WYs if between December 1 and February 1 there are no instances in which for two consecutive days flows are greater than 3,000 cfs as measured at the Smartsville – USGS Streamflow Gage 11418000.

Date	*Schedule 5*	*Schedule 6*	*Conference Year*
February 1 – February 2	*3,000*	*2,850*	*2,745*
February 3	*1,850*	*1,700*	*1,595*
February 4	*1,000*	*850*	*745*
February 5	*750*	*600*	*495*
February 6	*600*	*450*	*345*

FWS 10(j) RECOMMENDATION 1 AND BLM 10(a) RECOMMENDATION 7

The FWS' FPA Section 10(j) recommendation 1 (Maintain Minimum Streamflows in Lower Yuba River to Conserve Salmonids and Ecosystem Function) and BLM's FPA Section 10(a) recommendation 7 (Maintain Minimum Streamflows in Lower Yuba River to Conserve Salmonids and Ecosystem Function) contain essentially the same proposed text revisions to YCWA's proposed Condition AR3 as those in CDFW's proposed Condition 2.5, and they contain exactly the same proposed changes to the lower Yuba River minimum flow requirements.

FWN 10(a) RECOMMENDATION I(A)

The FWN's Federal Power Act Section 10(a) recommendation I(A) states that the Commission should include the CDFW and FWS Federal Power Act Section 10(j) recommendations in YCWA's new license. The details and rationale of each component are discussed in more detail in the FWN's Comment Letter.

1.4.1 Stated Biological Objectives of Commenters' Recommended Revisions to YCWA's Proposed Condition AR3

The CDFW proposed Condition 2.5 includes: 1) conditional winter pulses in the drier water years (Schedule 5 and 6 and Conference Years) to trigger upstream migration of adult steelhead and to provide a cue for outmigration of juvenile spring-run Chinook salmon; 2) higher spring floodplain inundation flows in wetter water years (Schedule 1 and 2 Years) to enhance juvenile salmonid rearing, emigration, and survival, and to avoid a drop in flows prior to the end of the natural spring

inundation period ('spring gap'); and 3) spring pulse flows in almost all water years to trigger upstream migration of adult spring-run Chinook salmon; and 4) reduce the spring "gap," when flows otherwise would drop and then go back up. CDFW states that the primary reason for its proposed changes is that YCWA's proposed Condition AR3 does not contain sufficient components of a natural hydrograph to fully support anadromous salmonids' instream life histories. According to CDFW, YCWA's proposed Condition AR3 will not provide the components of the natural hydrograph that would provide timely migration cues and foraging habitat for juvenile salmonids in the floodplain and other areas outside of the main channel of the lower Yuba River (p. 85 of Enclosure B of CDFW's Comment Letter). Similarly, FWS states that the primary reason for its recommendations for changes to YCWA's proposed Condition AR3 is that the minimum flows in YCWA's proposed condition do not contain sufficient components of a natural hydrograph to fully support anadromous salmonid instream life-history (see p. 49 of USDOI's Comment Letter). BLM's rationale statement simly incorporates by reference FWS's rationale statement (see p. 110 of USDOI's Comment Letter).

Although CDFW's stated objective of …"*spring pulse flows in wet and dry water years to trigger upstream migration of adult spring-run Chinook salmon…..*" is somewhat vague, the corresponding FWN objective is more clearly stated as "*Increased minimum flows during early May of Schedule 5, 6 and Conference Years (spring pulse for salmon attraction)*" (see FWN comment letter, p. 11). The CDFW and FWN recommended minimum flow requirements do not contain any separate recommended spring pulse flow measures. Rather, the spring pulse flow component of their proposal is embedded in their minimum flow requirement recommendation.

1.5 YCWA's Response to Commenters' Recommended Revisions to AR3

The FERC should not include the CDFW's FPA Section 10(j) recommended condition 2.5, FWS's FPA Section 10(j) recommended condition 1, the BLM's FPA Section 10(a) recommended condition 7, or the FWN's recommended condition I(A) in YCWA's new license for the following reasons, which are discussed in detail in the following subsections of this report.

FERC should not make the commenters' recommended changes to YCWA's proposed Condition AR3 for higher spring flow requirements.

1. The commenters' recommendation does not recognize the interactions in the lower Yuba River between flow and physical habitat structure, or the fact that the resultant juvenile rearing habitat conditions are primarily due to factors that do not have a direct nexus to the Project, including the ongoing effects of past hydraulic mining, relocation, reconfiguration and channelization of the lower Yuba River and reductions in channel meanders, and the limited habitat diversity and complexity.
2. The commenters' rationale for their recommendation for higher spring flows does not demonstrate that the current minimum instream flow requirements adversely affect anadromous salmonid populations, that YCWA's proposed Condition AR3 would have any such adverse effects, or that their recommendation would have any benefits for these populations.

3. The commenters' recommendation would not substantially increase the magnitude or duration of floodplain inundation, relative to the Base Case or YCWA's proposed Condition AR3.

4. The commenters' recommendation would not substantially increase the amount of estimated juvenile salmonid rearing habitat (WUA) during the spring period.

FERC should not make the commenters' recommended changes to YCWA's proposed Condition AR3 for higher minimum flows during early May of Schedule 5, 6 and Conference Years.

5. The commenters' rationale statements do not provide substantial evidence regarding the need for spring-run Chinook salmon attraction flows.

6. The commenters' rational statements do not recognize the scientific information demonstrating that spring-run Chinook salmon attraction to the lower Yuba River depends upon the differences in both flows and water temperatures between the Yuba and Feather rivers, and not on any specific flow rate.

7. The commenters' rationale statements do not demonstrate that attraction into the lower Yuba River would be substantively different with commenters' proposed flows, relative to either the flows associated with the current (Base Case) or YCWA's proposed Condition AR3 minimum instream flow requirements.

8. The commenters' rationale statements do not acknowledge or consider the scientific evidence that attraction of Chinook salmon into the lower Yuba River is associated with strays, including hatchery strays, and that such attraction would be contrary to NMFS's 2014 Recovery Plan for Anadromous Salmonids in the Central Valley.

FERC should not make the commenters' recommended changes to YCWA's proposed Condition AR3 for higher minimum flows to address the "spring gap".

9. CDFW's, FWS's and FWN's recommendations for flows to avoid a "spring gap" are inconsistent with their other statements favoring a more-natural hydrograph.

10. CDFW's statement that its recommended flow regime would increase springtime floodplain inundation is incorrect. Flows associated with CDFW's recommended flow regime would not exceed the bankfull flow of 5,000 cfs and, therefore, would not inundate the floodplain. Rather, they would just provide more flow within the channel.

FERC should not make the commenters' recommended changes to YCWA's proposed Condition AR3 for conditional winter pulses in Schedule 5 and 6 Years and Conference Years.

11. The commenters' recommendation and rationale statements do not provide substantial evidence regarding the need for winter pulse flows to facilitate adult

steelhead upstream passage. Empirical data of adult steelhead upstream passage at Daguerre Point Dam and associated flows demonstrate that a winter pulse flow is not needed to provide adult steelhead upstream passage in the lower Yuba River.

12. The commenters' recommendation and rationale statements do not establish a relationship between pulse flows of the recommended magnitudes and adult steelhead upstream passage rates.

13. The commenters' recommendation and rationale statements do not acknowledge or consider the potential for re-directed impacts to steelhead in the lower Yuba River.

14. The commenters' proposal improperly relies on the NMFS 2014 Final Recovery Plan.

The commenters' recommended changes to AR3 for conditional winter pulse flows in drier years (scenario AR3b) would not accomplish their stated objective of providing a cue for outmigration of juvenile spring-run Chinook salmon.

15. The commenters' rationale statements do not provide substantial evidence regarding the need for pulse flows to facilitate outmigration of juvenile spring-run Chinook salmon.

16. The commenters' rationale statements do not establish a relationship between the proposed pulse flows and juvenile Chinook salmon outmigration rates.

17. The commenters' recommendation and rationale statements do not acknowledge or consider the potential for re-directed impacts to juvenile spring-run Chinook salmon associated with downstream displacement.

18. The commenters' recommendation would not substantially increase the amounts of estimated juvenile salmonid rearing habitat (WUA) during the spring period.

The commenters' recommended changes to Condition AR3 would result in significant costs in terms of reduced operational flexibility, reduced water transfers and reduced revenue generation. (See section 1.5.4.2 for additional discussion.)

1.5.1 YCWA's Analyses of Commenters' Recommended Revisions to AR3

The following subsections of this report include evaluations of the incremental effects of two different components of the commenters' recommended changes to AR3, and of the combination thereof. As a result, there are the following three evaluated scenarios:

- Scenario AR3a – maintain commenters' proposed minimum streamflows (Minimum Flows Only). This scenario does not include commenters' proposed winter pulse flows, and is referred to in this document as FWS_CDFW_FWN -AR3a.

- Scenario AR3b – maintain commenters' proposed winter pulse flows (Winter Pulse Only). This scenario does not include commenter's other proposed minimum flows, and is referred to in this document as FWS_CDFW_FWN -AR3b.
- Scenario AR3 - maintain commenters' prposed minimum streamflows and winter puslel flows (Minimum Flow + Winter Pulse). This scenario includes commenters' proposed minimum flows and winter pulse flows, and is referred to in this document as FWS_CDFW_FWN -AR3.

Each of these three scenarios was evaluated to determine whether, and to what degree, each increment would accomplish the stated objectives. These evaluations were conducted using YCWA's YRDP daily operations model. Biological evaluations included anadromous salmonid species/run and lifestage-specific analyses comparing the commenters' recommendation, the AFLA and the Base Case.

The results of comprehensive re-directed impact evaluations, for both physical habitat and water temperatures conditions, are presented in YCWA's technical report regarding comments on YCWA's proposed Condition AR9, for the combination of all recommendations regarding the lower Yuba River, and in YCWA's technical report regarding the combined CDFW/USFWS/FWN recommendations, for the combination of all proposed actions regarding both the upper Yuba River watershed and the lower Yuba River.

1.5.1.1 Species and Lifestage Specific Analysis

YCWA utilized its YRDP daily operations model for a 41-year period of simulation (WY 1970 – 2010) to evaluate the commenters' proposed changes to YCWA's proposed Condition AR3. Due to the nature of the changes associated with the commenters' recommended changes to YCWA's Condition AR3 (increase magnitude of minimum flow requirements during spring and new winter pulse flow requirements) and commenters' stated biological objectives, YCWA's physical habitat evaluations focused on the species and lifestages that occur during the periods when commenters' proposed changes would occur. Specifically, the commenters' minimum flow recommendations are for the March 1 through May 31 time period, so this report's evaluation was conducted for rearing habitat for the species and run lifestages that are present during that time period, as discussed in the following tables and text.

Spring-run Chinook Salmon

Table AR3-1. Lifestage-specific periodicities for spring-run Chinook salmon in the lower Yuba River.

Lifestage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
SPRING-RUN CHINOOK SALMON												
Adult Immigration & Holding												
Spawning												
Embryo Incubation												
Fry Rearing												
Juvenile Rearing												
Juvenile Downstream Movement												
Smolt (Yearling+) Emigration												

Source: RMT 2013.

- According to RMT (2013), the spring-run Chinook salmon fry rearing period extends from mid-November through mid-February, and larger juveniles prevail by the end of this period. Consequently, spring-run Chinook salmon fry rearing habitat conditions would not be directly affected by the commenters' proposed changes in minimum flow requirements for the March 1 through May 31 period. Consequently, this report does not evaluate the effects of these proposed changes on spring-run Chinook salmon fry rearing.
- This report evaluates spring-run Chinook salmon juvenile rearing habitat (WUA in square feet (sq ft)), using the agreed-upon Relicensing Participants Habitat Suitability Criteria (HSC) with cover specified in Technical Memorandum (TM) 7.10, *Instream Flow Below Englebright Dam*, under the Base Case, AFLA and commenters' recommendation scenarios for the March 1 through May 31 portion of the juvenile rearing period.

Fall-run Chinook Salmon

Table AR3-2. Lifestage-specific periodicities for fall-run Chinook salmon in the lower Yuba River.

Lifestage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fall-run Chinook Salmon												
Adult Immigration & Staging												
Spawning												
Embryo Incubation												
Fry Rearing												
Juvenile Rearing												
Juvenile Downstream Movement												

Source: RMT 2013

- This report evaluates fall-run Chinook salmon fry rearing habitat (WUA in sq ft), using the agreed-upon Relicensing Participants HSC with cover specified in TM 7.10 under the Base Case, AFLA and commenters' recommendation scenarios for the March 1 through April 30 portion of the fry rearing period.

- This report evaluates fall-run Chinook salmon juvenile rearing habitat (WUA in sq ft), using the agreed-upon Relicensing Participants HSC with cover specified in TM 7.10 under the Base Case, AFLA and commenters' recommendation scenarios for the March 1 through May 31 portion of the juvenile rearing time period.

Steelhead

Table AR3-3. Lifestage-specific periodicities for steelhead in the lower Yuba River.

Lifestage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Adult Immigration & Holding	■	■	■	■	■	■	□	□	□	■	■	■	■	■	■	■	■	■	■	■	■	■
Spawning	■	■	■	■	■	■	■	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Embryo Incubation	■	■	■	■	■	■	■	■	■	■	□	□	□	□	□	□	□	□	□	□	□	□
Fry Rearing	□	□	□	□	□	□	■	■	■	■	■	■	■	■	□	□	□	□	□	□	□	□
Juvenile Rearing	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Juvenile Downstream Movement	□	□	□	□	□	□	■	■	■	■	■	■	■	■	■	■	■	■	□	□	□	□
Smolt (Yearling+) Emigration	■	■	■	■	■	■	■	□	□	□	□	□	□	□	□	□	■	■	■	■	■	■

Source: RMT 2013

- This report evaluates steelhead fry rearing habitat (WUA in sq ft), using the agreed-upon Relicensing Participants HSC with cover specified in TM 7.10 under the Base Case, AFLA and commenters' recommendation scenarios for the April 1 through May 31 portion of the fry rearing period.
- This report evaluates steelhead juvenile rearing habitat (WUA in sq ft), using the agreed-upon Relicensing Participants HSC with cover specified in TM 7.10 under the Base Case, AFLA and commenters' recommendation scenarios for the March 1 through May 31 portion of the juvenile rearing period.

1.5.2 Scenario AR3a –Commenters' Proposed Minimum Streamflows (Minimum Flows Only) (FWS_CDFW_FWN -AR3a)

FERC should not make the commenters' recommended changes to YCWA's proposed Condition AR3 for higher spring flow requirements.

Juvenile Salmonid Rearing Habitat

1.5.2.1 The commenters' recommendation does not recognize the interactions in the lower Yuba River between flow and physical habitat structure, or the fact that the resultant

> juvenile rearing habitat conditions are primarily due to factors that do not have a direct nexus to the Project, including the ongoing effects of past hydraulic mining, relocation, reconfiguration and channelization of the lower Yuba River and reductions in channel meanders, and the limited habitat diversity and complexity.

CDFW's rationale statement (p. 90) attempts to establish a nexus between habitat availably for juvenile salmonids and the Project with the following qualitative discussion of riparian floodplain inundation and general effects of hydropower project: "*With the understanding that a high number of acre-days of inundation is likely to result in high juvenile salmonid survival, and that hydropower projects reduce the inundation area and frequency of inundation of the riparian edge, the USFWS chose this metric to analyze the effect of the Project on juvenile salmonid habitat in the lower Yuba River*."

The problem of CDFW's reliance on statements about general river conditions without considering specific conditions in the lower Yuba River is highlighted by the following statement by U.C. Davis Professor Greg Pasternack, who has conducted extensive research on lower Yuba River hydraulic conditions: *"The fluvial geomorphology of the Yuba River is so unique that it is crucial to evaluate it on its own terms and not to apply simple generalizations and concepts from other rivers with dams (Pasternack 2010)."*[2]

CDFW (p. 88 of CDFW's Rationale Report) correctly recognizes that…"*The lower Yuba River is not a littoral-rich system. The historical loss of riparian overstory from gold rush era cord-wood harvest and hydraulic-mining induced historical sedimentation, the rough material substrate (from sediment retention and Englebright Dam and from historical and contemporary mining), channel incision, and changes in natural flow regimes resulting from dam construction*…"

The next part of CDFW's statement is: "…*and Project operations have all resulted in a river that lacks an abundance of large riparian trees and the small woody material that makes up the moving littora*l." This statement is not correct. It is inappropriate for CDFW to include Project operations in the suite of historical anthropogenic actions in the Yuba River watershed that have impacted lower Yuba River channel conditions, and CDFW has not provided any substantial evidence to support its argument about the effects of Project operations.

CDFW's justification for its recommendation for higher spring flows appears to be based on the following general statement in the literature: "*A river's flow regime affects the ability of that river to recruit large overstory trees and to support diverse riparian structure and composition (Bovee and Scott 2002, Lytle and Poff 2004, Poff et al. 2007, Poff and Zimmerman 2010, Richter and Richter 2000),*" (see CDFW Notice of Intervention, pg. 199). Even though numerous studies on physical habitat and structure, riparian vegetation and channel complexity have been conducted on the lower Yuba River (Wyrick and Pasternack 2012, Carley et al. 2012, James et al. 2012, Pasternack 2010, White et al. 2010, James et al. 2009), CDFW's rationale statement for its proposed Condition 2.5 does not discuss or even refer to any of these studies.

[2] Quotation taken from page BA6-66 of the Applicant-Prepared Draft BA in YCWA's AFLA.

The Applicant-Prepared Draft Biological Assessment (BA) clearly presented, discussed and described the interaction between flow and physical habitat structure, and the fact that the existing juvenile rearing habitat conditions in the lower Yuba River are the direct result of pre-project anthropogenic perturbations, which have no nexus to the Project. Specifically, Section 6.0 of the Applicant-Prepared Draft BA provided a comprehensive overview of the historical (pre-Project) conditions of the Yuba River Watershed (see pg. BA6-2 through pg. BA6-52), and discussed hydraulic gold mining, construction of levees and gravel berms, dredging, dam construction, and the historical geomorphology along the lower Yuba River.

The following excerpts from the Applicant-Prepared Draft BA provide examples of information demonstrating that there is no nexus between existing lower Yuba River juvenile rearing habitat conditions and the Project.

- Pg. BA6-23 - Hydraulic mining in the Yuba River watershed during the mid-1800s contributed large quantities of sediment to the river. About 600 million cubic yards of material exposed by hydraulic mining had entered the Yuba River between 1849 and 1909 (Hagwood 1981). The sediment deposited in the channel raised the channel bed to the point that in 1868 it was higher than the streets in Marysville. Subsequent flooding of Marysville in the late 1800s led to attempts to mitigate the adverse effects of hydraulic mining (USACE 2005).
- Pg. BA6-65 - During the period of hydraulic gold mining, vast quantities of sand, gravel, and cobble entered the Yuba River (Gilbert 1917) and deposited throughout the system. This human impact completely transformed the river. Historical photos from 1909 and 1937 document that the canyon was filled with alluvial sediment with an assemblage of river features including riffles (Pasternack 2010).
- Pg. BA6-65 to BA6-66 - Confounding the natural response of the river to the potentially restorative impact of Englebright Dam, the lower Yuba River has been subjected to harmful in-channel human activities that further altered it. The greatest impact came from dredgers processing and re-processing most of the alluvium in the river valley in the search for residual gold and to control the river (James et al. 2009). First, there was the formation of the approximately 10,000 ac Yuba Goldfields in the ancestral migration belt. Subsequently, there was the relocation of the river to the Yuba Goldfield's northern edge and its isolation from most of the Goldfields by large "gravel berms" of piled-up dredger spoils. Dredger-spoil gravel berms also exist further upstream in Timbuctoo Bend off the Yuba Goldfields; these berms provide no flood-control benefit (Pasternack 2010).
- Pg. BA6-76 - Historically, gravel berms hindered the meandering nature of the lower Yuba River and ultimately confined the lateral limits of the river to a narrow corridor at the northern extent of its historic floodplain. As a result, riparian vegetation that historically was established on higher surfaces that were once inundated about every other year and also had a shallow groundwater influence, were eliminated and no new riparian vegetation could regenerate on higher remnant floodplain surfaces (cbec and McBain & Trush 2010).
- Pgs. BA6-11 to BA6-12 - Review of aerial photographs taken over time has provided some qualitative views and representation of changes that have occurred in the lower Yuba River channel over the past. Between 1947 and 1970, the lower Yuba River within the Dry Creek

study site experienced dramatic changes to the channel location and morphology, partly due to anthropogenic activities. The 1947 photo shows dredger mining operations on the north and south side of the valley, and the river flowing as a single-thread channel. By 1970, the mining operations on the north side had ceased and the south side operations had expanded northward into the valley, thus forcing the channel farther north as well. Also by 1970, the channel has switched from a single-thread stream to a multi-thread or braided stream. The channel is currently less braided than in 1970, but still exhibits flow splits and backwater regions at this site. From a geomorphic perspective, a change from single-thread to multi-thread channels generally means an increase in sediment load and thus a decrease in stability. By distributing the flow among several pathways, the overall width-depth ratio also generally increases.

- Pg. BA6-66 - The lower Yuba River downstream of Englebright Dam continues to change in response to the complex assemblage of natural processes and human impacts. The legacy of hydraulic mining is the first and foremost impact to the system. Englebright Dam blocks further impacts from upstream mining debris, and is directing the river on a trajectory toward restoration of the pre-existing landform (Pasternack 2010). Daguerre Point Dam serves as a stabilizer in the system, providing a base level for the extent of incision between Daguerre Point and Englebright dams. Mechanized re-working of alluvium and associated channelization have dictated the lateral bounds of the river, and also impact the diversity and distribution of river-corridor landforms. The fluvial geomorphology of the Yuba River is so unique that it is crucial to evaluate it on its own terms and not to apply simple generalizations and concepts from other rivers with dams (Pasternack 2010).

Lower Yuba River physical habitat conditions are thoroughly described on pages BA6-52 through BA6-82 of the Applicant-Prepared Draft BA. Topics related to spatial structure and fluvial geomorphology discussed in the BA include: (1) macro-habitat analysis; (2) segment scale and inundation zones; (3) floodplain connection; (4) channel classification; (5) reach scale evaluation; (6) morphological unit definition and delineation; (7) channel complexity and habitat diversity; (8) salmonid spawning substrate suitability and availability; (9) morphological unit availability and diversity at baseflow for salmonid lifestages; (10) fluvial geomorphic processes; and (11) riparian vegetation.

Similar to the characterization of historical anthropogenic impacts that have affected juvenile rearing habitat conditions in the lower Yuba River, the Applicant-Prepared Draft BA also discussed in detail the factors affecting juvenile rearing habitat diversity and complexity. The following are a few examples of these discussions:

- Pg. BA6-78 - Based on field observations, YCWA (2013) reported that all reaches supported woody species in various life stages – that is, mature trees, recruits, and seedlings were observed within all reaches. Where individuals or groups of trees were less vigorous, beaver (*Castor canadensis*) activity was the main cause, although some trees in the Marysville Reach appeared to be damaged by human camping.
- Pg. BA6-78 - YCWA (2013) assessed the riparian communities in the Yuba River downstream of the Englebright Dam as healthy and recovering from historical disturbance.

Historical aerial photograph analysis indicates that vegetation cover has increased over time, with short-term decreases associated with stochastic flow events, which are normal for riparian systems, and anthropogenic channel changes.

- Pg. BA6-78 - Bands of willows on the floodplains, with some alder and cottonwood recruits, are early in the seral process and still capturing sediment or developing soils to support more productive systems. However, these areas on the floodplains may not become more complex, as they are likely to be scoured during peak flow events (YCWA 2013).
- Pg. BA6-78 - Areas dominated by cottonwood trees with only herbaceous understories (e.g., those found on levees), are likely a sign of interrupted riparian development, and maintenance of the levees may have prevented the natural stages of the riparian community to develop.

Based on all of the information presented, the Applicant-Prepared Draft BA (pg. BA8-17) concluded that:

> As a stressor, flow-dependent rearing habitat availability is distinct from rearing habitat physical structure. The geomorphic conditions caused by hydraulic and dredge mining since the mid-1800s, and the construction of Englebright Dam, continue to limit habitat complexity and diversity in the lower Yuba River. Physical habitat structure components providing instream object and overhead cover, as well as high channel sinuosity and hydraulic complexity, can be generally characterized as limited in the lower Yuba River.
>
> Restricted availability of complex, diverse habitats associated with the loss of natural river morphology and function, combined with limited availability of physical habitat structure components providing instream and overhead object cover, represents a high stressor to rearing juvenile anadromous salmonids under the Environmental Baseline.

Section 9 of the Applicant-Prepared Draft BA (pgs. BA9-8 and BA9-10) further concluded that fry and juvenile rearing physical habitat structure represents a high stressor for both spring-run Chinook salmon and steelhead under the Environmental Baseline (i.e., existing condition). YCWA's analysis demonstrated that these stressors have not been, and will not be, affected by the Project, and that their stressor level categorizations therefore will not change under the Project, relative to the Environmental Baseline.

With respect to flow-related habitat availability, complexity and diversity, YCWA's Applicant-Prepared Draft BA (pg. BA5-45) quoted a statement in NMFS (2014) Recovery Plan that "*Implementation of the flow schedules specified in the Fisheries Agreement of the Yuba Accord is expected to address the flow-related major stressors including flow-dependent habitat availability, flow-related habitat complexity and diversity, and water temperatures*." The analyses conducted in the Applicant-Prepared Draft BA (Section 8) also confirm the conclusion in NMFS (2014).

Consequently, YCWA has demonstrated that past watershed impacts affecting juvenile anadromous salmonid rearing habitat conditions in the lower Yuba River are not attributable to the Project, and that the Yuba Accord schedules of minimum flow requirements are sufficient to address flow-related effects of the Project. Because higher minimum flow requirements will not correct the physical habitat structure limitations that pre-existed the Project, FERC should not change YCWA's proposed Condition AR3 to add the commenters' proposed higher spring flows.

1.5.2.2 The commenters' rationale for their recommendation for higher spring flows does not demonstrate that the current minimum instream flow requirements adversely affect anadromous salmonid populations, that YCWA's proposed Condition AR3 would have any such adverse effects, or that their recommendation would have any benefits for these populations.

Floodplain Inundation Considerations

USDOI's Comment Letter (pg. 58) states "*Increased flows and/or lowering floodplains surfaces are the only way to increase areas of inundation*." The comment letter goes on to state that surface lowering would enhance connectivity with floodplain habitats necessary for rearing juvenile salmonids. This section of the comment letter attempts to justify the conclusion that juvenile salmonid rearing habitat, and particularly optimal rearing habitat, can only exist in an inundated floodplain rather than in-channel habitats.

- This statement is unsupported and incorrect. Physical (non-flow) habitat enhancement measures could be implemented within in-channel areas (i.e., those that occur at river flows <5,000 cfs) to increase the number of acres of juvenile rearing habitat that could be inundated more frequently, and with greater duration at various flow levels.

- In fact, the above statement directly contradicts the following statements in USDOI's rationale (pg. 61) for its FPA Section 10(j) recommendation 3 - Restore Juvenile Rearing Habitat in the Lower Yuba River:

> "*The USFWS has been committed to understanding existing habitat conditions in the lower Yuba River and improving them with a goal of increasing natural production of salmonids in the lower Yuba River. The USFWS and other partners have made substantial financial investments to improve the lower Yuba River's riparian corridor to address the needs of salmonids. …The USFWS has demonstrated that riparian restoration on the Yuba River is attainable at a reasonable cost. The USFWS has planned, finished, or funded 235 acres of riparian and floodplain restoration on the Yuba River, between 2012 and 2017, at a cost of approximately $4.5 million.*"

In fact, all of the 235 acres were in-channel actions. For these reasons, it is inconsistent for USDOI to contend that "*Increased flows and/or lowering floodplains surfaces <u>are the only way to increase areas of inundation</u>.*", and

consequently to increase juvenile salmonid rearing habitat, while at the same time USFWS is promoting efforts to improve in-channel habitat.

- USDOI's Comment Letter (pg. 59) states: "*Median inundation, at elevations greater than 5,000 cfs, was reduced by 56% in all water years and by 29% during Schedule 1 water years. This also represents severe reductions in juvenile rearing habitat*."

    - First, it is also unclear what USDOI considers to be a "severe reduction" in juvenile rearing habitat, because the USDOI Comment Letter does not clearly equate the referenced flow changes to any changes in juvenile rearing habitat.
    - Second, the USDOI Comment Letter does not provide any biological analyses specific to the lower Yuba River regarding the relationship between inundation and juvenile rearing habitat, nor does it describe how changes in hydrologic conditions influence inundation elevations to result in "severe reductions" in juvenile rearing habitat. Also, the USDOI Comment Letter does not provide any linkage between its unsubstantiated conclusions regarding juvenile rearing habitat and survival or population effects.
    - Third, USDOI's statement that median inundation *"was reduced by 56% in all water years and by 29% during Schedule 1 water years…"*attempts to compare current Project operations with a "without project" hydrology, which is not the appropriate basis of comparison, because such comparison should be made to the "base condition".

Natural Hydrograph Issues

According to the USDOI's Comment Letter (pg. 14), components of the natural hydrograph that are "*diminished or altered by the Project are: (1) winter freshets; (2) winter and early spring high flows; (3) floodplain inundation amount, duration, and timing; (4) continuity of flows during spring; and (5) snowmelt moderated flow recession*."

The FWS rationale for its FPA § 10(j) recommendation 1 states (USDOI Comment Letter, pg. 49):

> "*The minimum flows in the AFLA do not contain sufficient components of a natural hydrograph to fully support anadromous salmonid instream life-history…A natural hydrograph provides important environmental conditions and cues that are essential to salmonid reproductive behavior and to population sustainability, but the AFLA flows do not provide these components of the natural hydrograph that would provide timely migration cues and foraging habitat for juvenile salmonids in the floodplain and other areas outside of the main channel…*"

CDFW's Comment Letter (pgs. 6-7) states that one of its resource objectives for the Project is a "Natural Hydrograph Objective" that is to: (1) develop and implement streamflow regimes that simulate the shape of the natural hydrograph in duration, magnitude, timing, rate of change, and frequency to the extent necessary to restore or protect applicable ecological functions. CDFW attempts to justify this objective with the statement that "*The natural, unregulated flow regime*

plays a critical role in sustaining native biodiversity and ecosystem integrity in rivers (Poff et al. 1997)."

CDFW (pg. 23 of its Rationale Report) states that one factor that was considered while developing its proposal was the "*importance of mimicking the natural hydrograph for the protection of overall ecosystem function and individual target biota*". CDFW (pg. 23 of its Rationale Report) also states "*Once spring time flows were developed, emphasis was placed on developing streamflow regimes that mimicked the natural hydrograph as much as possible for overall protection of the aquatic ecosystem…*" CDFW (pg. 24 of its Rationale Report) further states "*Minimum streamflows for this transition period were included to bridge the gap between low-flow and high-flow periods in a step-wise fashion and thus mimic the pattern of the natural hydrograph*". CDFW (pg. 34 of its Rationale Report) again states "*Flow recommendations should consider the extent the flow regime below a dam mimics natural flow regimes*."

The concept of "*mimicking the natural hydrograph*" is somewhat outdated and contradictory to the current scientific understanding about flow-related fisheries management efforts occurring throughout California (Fleenor et al. 2010, Yarnell et al. 2017, Zimmerman 2017; Zimmerman 2016), which are more appropriately adopting the concept of a functional flow approach. A functional flow approach is defined as "*a hydrograph component that provides a distinct geomorphic, ecologic or biogeochemical function*" (Yarnell et al. 2015, Zimmerman 2016). Key components of the functional flow approach include wet-season initiation flows, peak magnitude flows, recession flows, dry-season low flows, and interannual variability (Yarnell et al. 2015). According to Yarnell et al. (2015), the functional flow approach "*focuses on retaining specific process-based components of the hydrograph, or functional flows, rather than attempting to mimic the full natural flow regime*" [emphasis added].

Most recently, the Delta Independent Science Board, in its February 23, 2017 review of the SWRCB's "*Working Draft Scientific Basis Report for New and Revised Flow Requirements on the Sacramento River and Tributaries, Eastside Tributaries to the Delta, Delta Outflow, and Interior Delta Operations*" described functional flows as follows: "*Functional flows are a mechanistic approach for estimating flow needs and trade-offs (Yarnell, et al. 2015; DISB 2015). Flows needed are based on field observations of life stages and computer and conceptual models of hydrodynamics, habitat, and ecological conditions for different flows. Environmental flows are then chosen to support different ecological functions and life stages of selected species*."

Although there are several general statements alleging Project-related impacts, the FWS (in the USDOI Comment Letter) provides no hydrologic analysis or other type of technical analysis to demonstrate that the Project diminishes or alters components of the natural hydrograph in manners that result in adverse effects to anadromous salmonids in the lower Yuba River. To the contrary, the Without-Project scenario results in significantly less suitable water temperatures than the Environmental Baseline, as demonstrated in YCWA's AFLA BA (2017). Examination of the estimated water temperatures under the Without-Project scenario indicates that lethal water temperatures would occur during the over-summer juvenile rearing period for spring-run Chinook salmon and steelhead in the lower Yuba River under Without-Project conditions.

Similarly, except for a few brief general statements that refer to floodplain inundation, spring flows, pulse flow, and enhancement of riparian and aquatic habitat as "ecological functions" (see, e.g., pgs. 96, 98, 102 of CDFW's Rationale Report), CDFW does not identify the "applicable ecological functions" that must be restored or protected. Moreover, CDFW: (1) does not provide any biological explanation of specific "ecological functions" that CDFW considers to be important to lower Yuba River anadromous salmonids; (2) does not present any analyses indicating that specific components of "ecosystem functions" are lacking or impaired on the lower Yuba River; and (3) does not provide any analysis of what specific "ecological functions" would be improved by the implementation of its proposal.

1.5.2.3 The commenters' recommendation would not substantially increase the magnitude or duration of floodplain inundation, relative to the Base Case or YCWA's proposed Condition AR3.

YCWA conducted modeling comparing scenarios with YCWA's proposed Condition AR3a, with commenters' recommended minimum flow revisions to Condition AR3 (scenario AR3a), and the Base Case. Results of these comparisons demonstrate that:

- The CDFW and FWS recommended revisions to YCWA's proposed Condition AR3[3] would result in fewer days of inundation of the floodplain of the lower Yuba River from Englebright Dam to Daguerre Point Dam (the area that would be inundated at lower Yuba River flows above 5,000 cfs) than under Base Case conditions. Modeling results show that the CDFW and FWS recommended revisions to Condition AR3 would reduce the average number of days of inundation for all years from 25.5 to 24.8, and would reduce the median number of days of inundation for all years from 11 to 9, an 18 percent reduction.
- CDFW's rationale statement for the recommended revisions to Condition AR3 that these recommended revisions include "*Higher Spring Flows to Increase Floodplain Inundation …*" (p. 101 CDFW Comment Letter). The CDFW and FWS recommended revisions to Condition AR3 would result in a slight decrease in the frequency of inundation of the floodplain in wetter years. The CDFW and FWS recommended revisions to Condition AR3, for Schedule 1 and 2 years (which are 34 of the 41, which is 83 percent, of years modeled), would result in a 1 percent and 2 percent reduction in floodplain inundation expressed in acre-days for the average and median of these years, respectively, compared to the Base Case. The AFLA Condition AR3 flows would result in no change from the Base Case for these same years.
- CDFW, FWS and FWN relied upon the same FWS analysis and report on inundation to support their rationale for their recommended changes to Condition AR3. CDFW's letter states "*CDFW contributed to the development and refinement of the acre-day analysis and*

[3] The commenters recommended changes to AR9, *Control Project Ramping and Flow Fluctuations Downstream of Englebright Dam* that were to be included if their changes to YCWA's AR3 flows were adopted. The commenters' changes to YCWA's proposed Condition AR9 would eliminate flow fluctuation criteria during times when their increased spring flows would require greater releases when the Condition AR3 increased spring flows in Schedule 1 and Schedule 2 would end. YCWA's proposed Condition AR9 and the commenters' proposed changes to Condition AR9 were not included in the modeling for scenario AR3a. Please refer to YCWA's separate technical report responding to comments on YCWA's proposed Condition AR9 for those modeling results.

fully supports its use to measure the Project's effect on winter and early spring high flows and floodplain inundation, duration, and timing." The report is attached to CDFW's Comment Letter at Appendix 1 and to the FWS Comment Letter at Appendix 3.

For this report, YCWA re-created the modeling of inundation using the methods and data described in the FWS report. The FWS created a definition of "ecologically relevant areas" of the lower Yuba River to identify inundation areas within the river channel that, along with the floodplain, FWS believes are important for habitat. YCWA does not support this definition, but recreated the analysis to determine the effect that the CDFW, FWS and FWN recommended modifications to Condition AR3 would have on inundation of this area. The results of this analysis, using the FWS criteria, show the CDFW, FWS, and FWN recommended modifications to Condition AR3 would not significantly increase inundation of the areas FWS denoted as "ecologically relevant areas." The differences in resulting inundation acre-days from the modeling analysis, between the Base Case and the CDFW, FWS, and FWN recommended modifications to Condition AR3 for the average of all years and the average and median of Schedule 1 and 2 years are less than 2 percent of number of inundation days under the Base Case. The following exceedance probability graph (Figure AR3-1) shows the similarities between the number of acre-days of inundation under the Base Case, AFLA Condition AR3 and the CDFW/USFWS/FWN recommended modifications to Condition AR3.

- Table 5 of the FWS report in Appendix 3 of the USDOI letter, which CDFW, FWS and FWN rely upon in their rationale statements (CDFW's Comment Letter, Appendix 1 and USDOI Comment Letter, Appendix 3) confirms that the commenters' recommendation would not substantively increase inundation compared to the inundation that would occur under the Base Case (referred to in this Table 5 as the "YRDP" scenario, see USDOI Comment Letter, App. 3, pg. 3). For Schedules 1 and 2, for which the commenters' proposal has large increases in spring minimum flow requirements and is the focus of the commenters' high spring flow recommendations, Table 5 of the FWS report lists the median inundation in Schedule 1 years as 32,686 acre-days for the "YRDP" scenario and 33,155 acre-days for the scenario with the commenters' recommendation, a difference of 1.4 percent. This Table 5 lists the median inundation in Schedule 2 years as 13,170 acre-days for the "YRDP" scenario and 13,319 acre-days for the scenario with the commenters' recommendation, a difference of 1.1 percent. Dividing the median inundation in acre-days by the median number of days of inundation results in an estimate of the difference in median area of inundation. The median number of days of inundation for Schedule 1 years is 135 days in the February 1 to June 15 period, which is every day of that period, and the median number of inundation days for Schedule 2 is 91 days. Therefore the difference in estimated inundation acres in Schedule 1 at the median is 3.5 acres ((33,686-31,155)/135 = 3.5 acres) and the difference in estimated inundation acres for the median of Schedule 2 years is 1.6 acres ((13,319-13,170)/91=1.6).

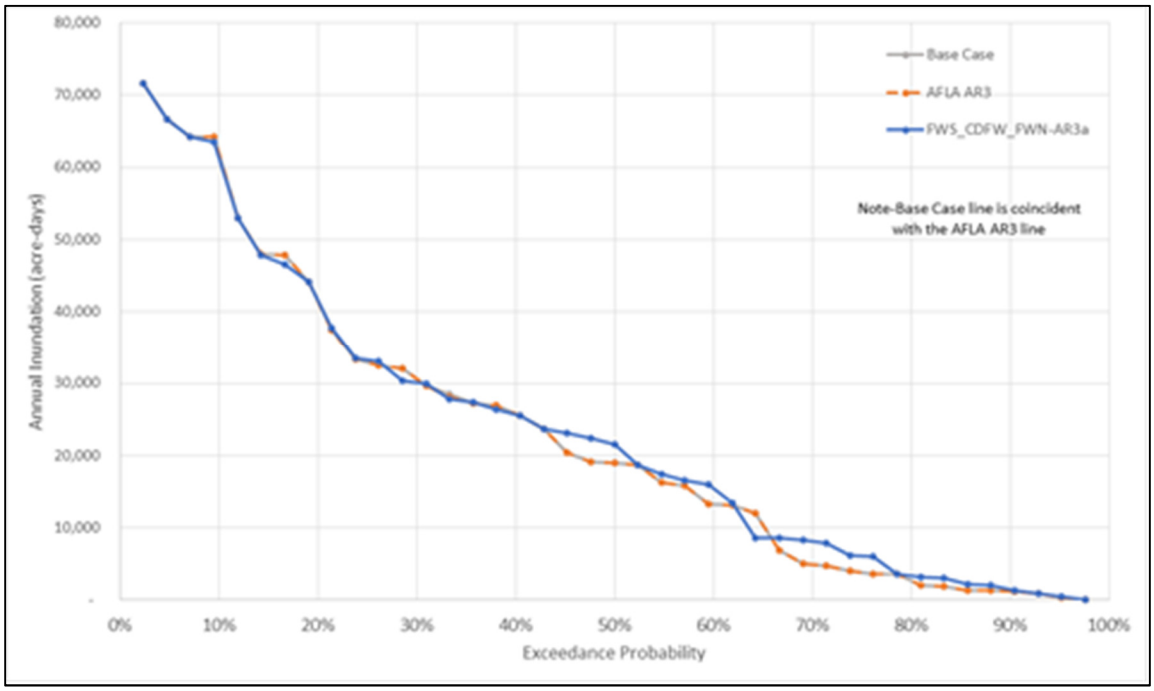

Figure AR3-1. Exceedance probability of annual inundation of the lower Yuba River in acre-days for the Base Case, AFLA Condition AR3, and CFW/FWS/FWN recommended modifications to Condition AR3 using FWS inundation criteria.

1.5.2.4 The commenters' recommendation would not substantially increase the amount of estimated juvenile salmonid rearing habitat (WUA) during the spring period.

YCWA conducted modeling for this report, comparing the AFLA AR3a scenario, scenario AR3a with commenters' recommended revisions, and the Base Case (see "Attachment AR3 – Model Output and Evaluation)". Results of these comparisons demonstrate that the commenters' recommendation would not substantially increase the amount of estimated juvenile salmonid rearing habitat (WUA) during the spring period. In fact, there are no substantive differences in estimated fry or juvenile rearing habitat for spring-run Chinook salmon, fall-run Chinook salmon, or steelhead for under the scenario AR3a with commenters' recommended revisions, relative to either the AFLA AR3a scenario or the Base Case.

Spring-run Chinook Salmon

YCWA compared spring-run Chinook salmon juvenile rearing habitat (WUA in sq ft), using the agreed-upon Relicensing Participants HSC with cover specified in TM 7.10, for the Base Case, the AFLA scenario and the scenario with commenters' recommendation for the March 1 through May 31 portion of the juvenile rearing period.

- As shown in Figure AR3-2, estimated amounts of juvenile spring-run Chinook salmon rearing habitat are essentially identical among all three scenarios over the entire exceedance probability distributions.

Fall-run Chinook Salmon

YCWA compared fall-run Chinook salmon fry rearing habitat (WUA in sq ft), using the agreed-upon Relicensing Participants HSC with cover specified in TM 7.10, for the Base Case scenario, the AFLA scenario, and the scenario with commenters' recommendation for the March 1 through April 30 portion of the fry rearing period.

- As shown in Figure AR3-3, estimated amounts of fall-run Chinook salmon fry rearing habitat are essentially identical among all three scenarios over the entire exceedance probability distributions.

YCWA compared fall-run Chinook salmon juvenile rearing habitat (WUA in sq ft), using the agreed-upon Relicensing Participants HSC with cover specified in TM 7.10, for the Base Case scenario, the AFLA scenario and the scenario with commenters' recommendation for the March 1 through May 31 portion of the juvenile rearing time period.

- As shown in Figure AR3-4, estimated amounts of juvenile fall-run Chinook salmon rearing habitat are essentially identical for all three scenarios over the entire distribution.

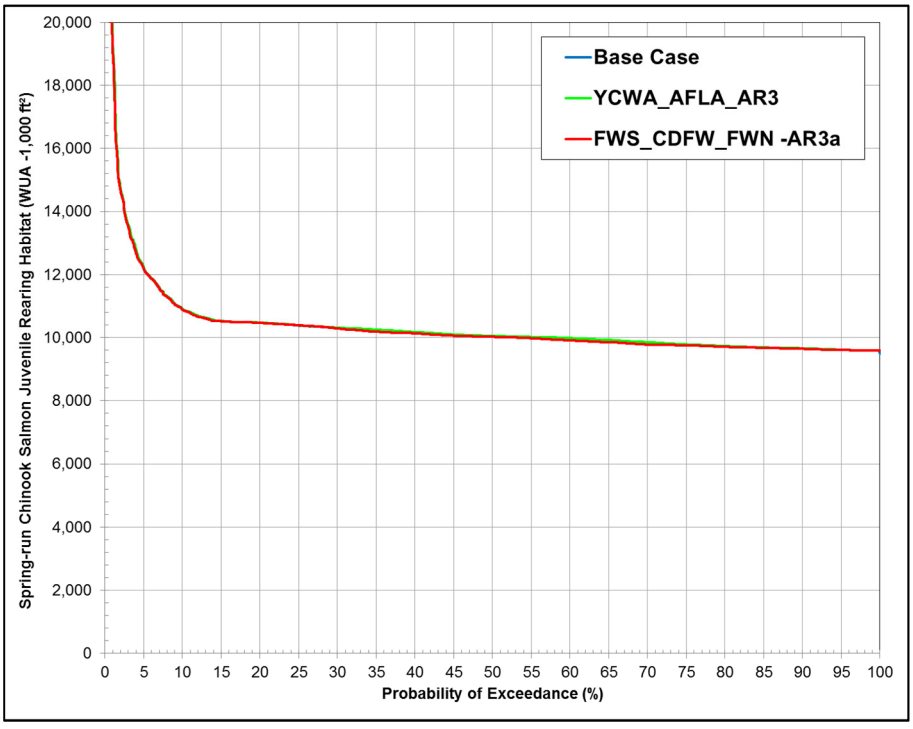

Figure AR3-2. Spring-run Chinook salmon juvenile rearing habitat duration over the 41-year hydrologic period for the March 1 through May 31 portion of the lifestage for the Base Case, YCWA_AFLA_AR3, and FWS_CDFW_FWN –AR3a scenarios.

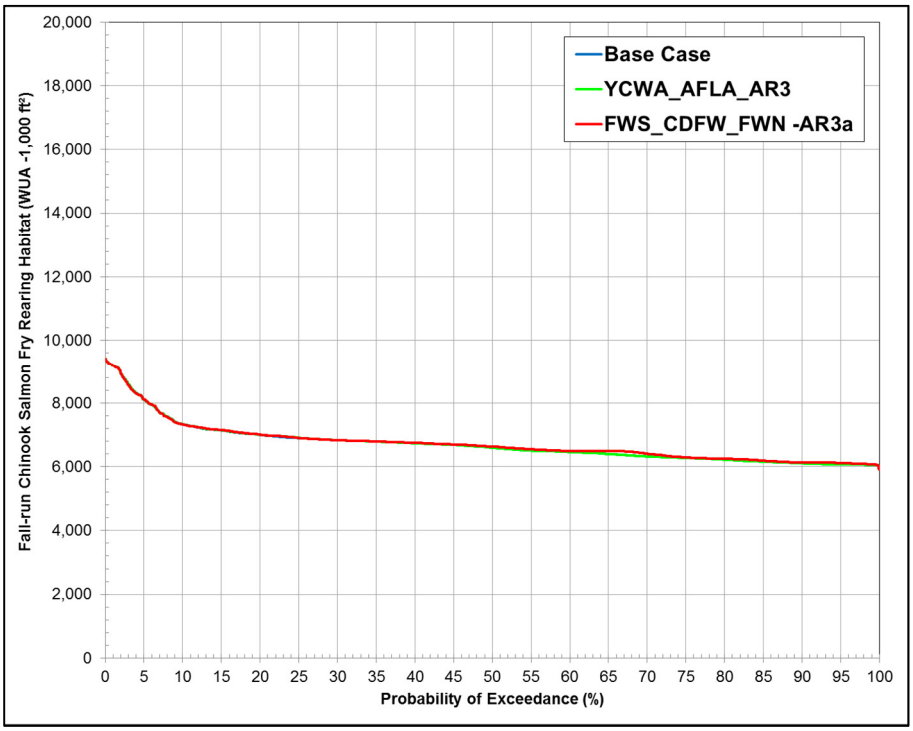

Figure AR3-3. Fall-run Chinook salmon fry rearing habitat duration over the 41-year hydrologic period for the March 1 through April 30 portion of the lifestage for the Base Case, YCWA_AFLA_AR3, and FWS_CDFW_FWN –AR3a scenarios.

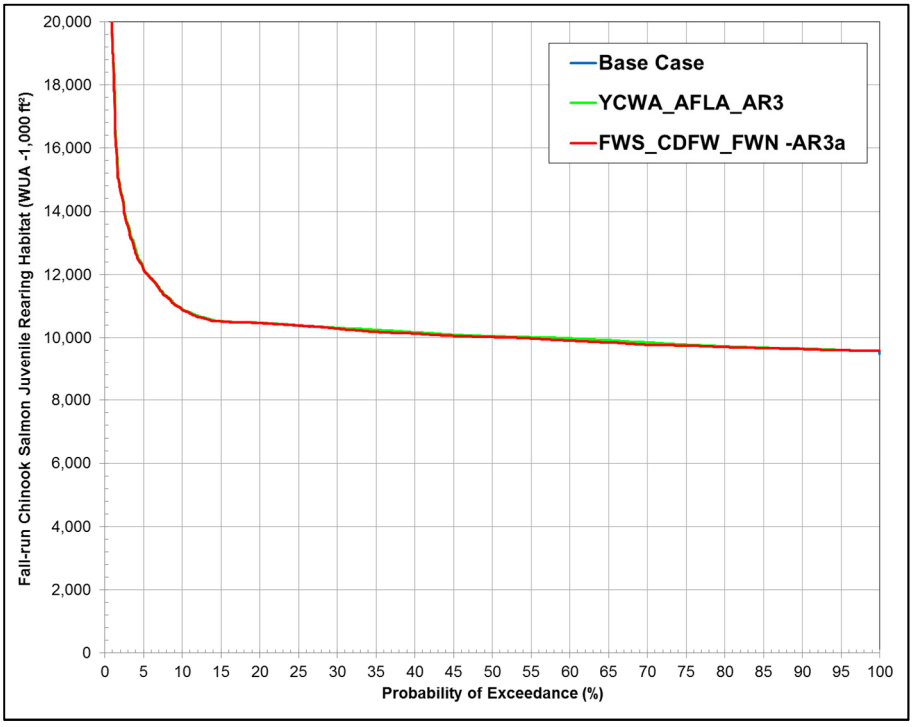

Figure AR3-4. Fall-run Chinook salmon juvenile rearing habitat duration over the 41-year hydrologic period for the March 1 through May 31 portion of the lifestage for the Base Case, YCWA_AFLA_AR3, and FWS_CDFW_FWN –AR3a scenarios.

Steelhead

YCWA compared steelhead fry rearing habitat (WUA in sq ft), using the agreed-upon Relicensing Participants HSC with cover specified in TM 7.10, for the Base Case scenario, the AFLA scenario and the scenario with commenters' recommendation for the April 1 through May 31 portion of the fry rearing period.

- As shown in Figure AR3-5, amounts of estimated steelhead fry rearing habitat are essentially identical for all three scenarios over the entire distribution.

YCWA compared steelhead juvenile rearing habitat (WUA in sq ft), using the agreed-upon Relicensing Participants HSC with cover specified in TM 7.10, for the Base Case scenario, the AFLA scenario and the scenario with commenters' recommendation for the March 1 through May 31 portion of the juvenile rearing period.

- As shown in Figure AR3-6, estimated amounts of juvenile steelhead rearing habitat are essentially identical for all three scenarios over the entire distribution.

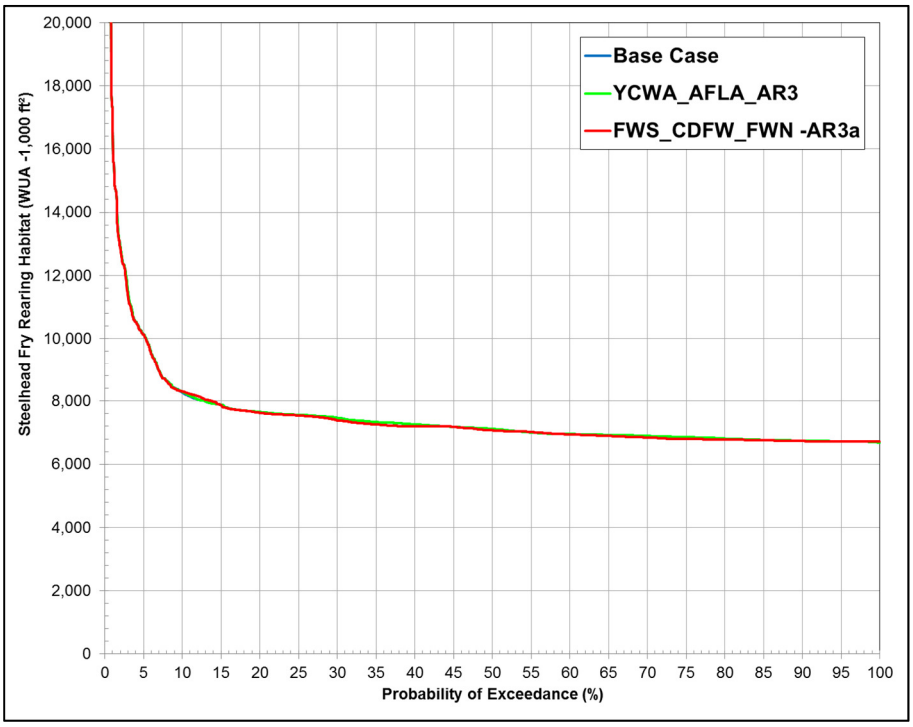

Figure AR3-5. Steelhead fry rearing habitat duration over the 41-year hydrologic period for the April 1 through May 31 portion of the lifestage for the Base Case, YCWA_AFLA_AR3, and FWS_CDFW_FWN –AR3a scenarios.

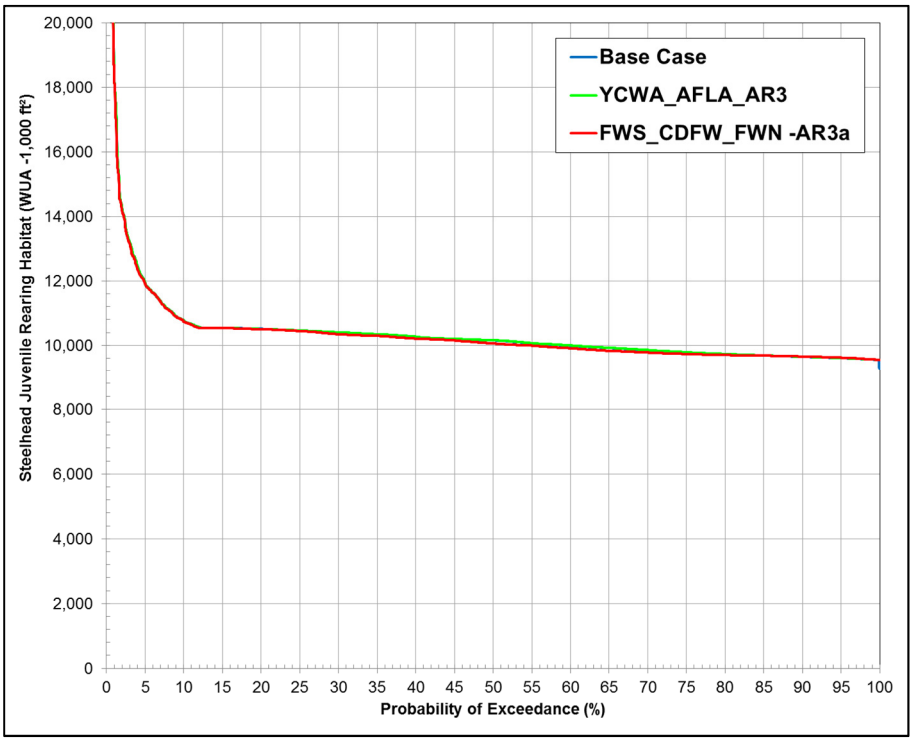

Figure AR3-6. Steelhead juvenile rearing habitat duration over the 41-year hydrologic period for the March 1 through May 31 portion of the lifestage for the Base Case, YCWA_AFLA_AR3, and FWS_CDFW_FWN –AR3a scenarios.

FERC should not make the commenters' recommended changes to YCWA's proposed Condition AR3 for higher minimum flows during early May of Schedule 5, 6 and Conference Years.

1.5.2.5 The commenters' rationale statements do not provide substantial evidence regarding the need for spring-run Chinook salmon attraction flows.

None of the comments on or recommended revisions to YCWA's proposed Condition AR3 contains any data, analyses or information indicating that attraction of spring-run Chinook salmon into the Yuba River is a problem. Moreover, these commenters have not presented any information that substantiates or supports the commenters' recommendation for higher minimum flow requirements during early May of Schedule 5, 6 and Conference Years.

1.5.2.6 The commenters' rationale statements do not recognize the scientific information demonstrating that spring-run Chinook salmon attraction to the lower Yuba River depends upon the differences in both flows and water temperatures between the Yuba and Feather rivers, and not on any specific flow rate.

As reported by RMT (2013), to evaluate the influence of "attraction" flows and water temperatures on the straying of adipose fin-clipped adult phenotypic spring-run Chinook salmon from the Feather River into the lower Yuba River, the RMT developed variables related to flows and water

temperatures in the lower Yuba River and the lower Feather River and statistically related them to the weekly proportions of adipose fin-clipped phenotypic spring-run Chinook salmon (relative to all spring-run Chinook salmon) passing upstream of Daguerre Point Dam.

Results of the RMT (2013) analysis suggest that there is a moderately strong (R^2=0.72) and highly significant (P < 0.000001) relationship between the percentage of adipose fin-clipped spring-run Chinook salmon contribution to the weekly spring-run Chinook salmon total counts at Daguerre Point Dam and the attraction flow and water temperatures four weeks earlier. The updated analysis which includes an additional year (March 2012 – February 2013), has similar results (YRDP BA). Results of the analysis applied to the 9 years of VAKI Riverwatcher™ counts available suggested that there also is a moderately strong (R^2=0.65) and highly significant (P < 0.000001) relationship between the weekly percentage of adipose fin-clipped spring-run Chinook salmon and the attraction flow and water temperature indices six weeks earlier, in contrast to four weeks earlier in the previous analysis.

The analysis showed that an estimated 65 percent of the variation in the proportion of adipose fin-clipped phenotypic spring-run Chinook salmon passing upstream of Daguerre Point Dam can be accounted for by the ratio of lower Yuba River flow relative to lower Feather River flow, and the ratio of lower Yuba River water temperature relative to lower Feather River water temperature, both measured six weeks before the time of the salmon passage at Daguerre Point Dam. In other words, the higher the Yuba River flows were relative to Feather River flows, and the lower the Yuba River water temperatures were relative to Feather River water temperatures, the higher the percentage of fin-clipped Chinook salmon in the total number of Chinook salmon that passed Daguerre Point Dam six weeks later.
This analyses indicates that the commenters' recommended increase in lower Yuba River flows during early May of Schedule 5, 6, and Conference Years, without consideration of the percentages of Yuba River flows and temperature relative to Feather River flows and temperatures, by itself would not be likely to attract spring-run Chinook salmon from the Feather River into the lower Yuba River.

1.3.2.7 The commenters' rationale statements do not demonstrate that attraction into the lower Yuba River would be substantively different with commenters' proposed flows, relative to either the flows associated with the current (Base Case) or YCWA's proposed Condition AR3 minimum instream flow requirements.

None of the comments or recommended revisions to YCWA's proposed Condition AR3 provides any data, analyses or information indicating that attraction of spring-run Chinook salmon into the Yuba River would be any different with the commenters' proposed lower Yuba River flows than with either the proposed AFLA Condition AR3 minimum instream flow requirements or the Base Case requirements.

1.5.2.8 The commenters' rationale statements do not acknowledge or consider the scientific evidence that attraction of Chinook salmon into the lower Yuba River is associated with strays, including hatchery strays, and that such attraction would be contrary to NMFS's 2014 Recovery Plan for Anadromous Salmonids in the Central Valley.

The estimated numbers of spring-run Chinook salmon of hatchery origin (i.e., adipose fin-clipped fish) and potentially non-hatchery origin (i.e., not adipose fin-clipped fish) passing upstream of Daguerre Point Dam from 2004 through 2015 from available VAKI Riverwatcher™ data were evaluated in YCWA's Applicant Prepared Draft BA. These data indicate that the percentages of the annual run of these fish that were adipose fin-clipped spring-run Chinook salmon ranged from 3 percent (2009) to 61 percent (2010), and averaged about 18 percent. It was recognized that these are minimum estimates, because not all strays in the lower Yuba River have adipose fin-clips.

Although it was not possible to differentiate between phenotypic spring- and fall-run Chinook salmon in the lower Yuba River carcass surveys, evaluation of the Yuba River carcass survey data and recovery of coded wire-tags indicated that hatchery-origin Chinook salmon comprised an estimated 71 percent of the total 2010 Chinook salmon run in the entire Yuba River downstream of Englebright Dam (Kormos et al. 2012, as cited in RMT 2013). Carcass survey data and recovery of coded-wire tags from 2011 indicate that approximately 34 percent of all Chinook salmon that spawned downstream of Daguerre Point Dam were of hatchery origin (Palmer-Zwahlen and Kormos 2013). VAKI Riverwatcher™ data, in conjunction with a biosample of 107 heads recovered during 2011 upstream of Daguerre Point Dam, indicate that approximately 65 percent of all spawning Chinook salmon upstream of Daguerre Point Dam were of hatchery origin (Palmer-Zwahlen and Kormos 2013).

Available information indicates that straying of fish of Feather River Fish Hatchery (FRFH) origin that are accounted for as "spring-run" Chinook salmon in the lower Yuba River occurs, and that this rate of straying is associated with the proportions of lower Yuba River flows and water temperatures relative to lower Feather River flows and water temperatures ("attraction flows and water temperatures").

Thus, even if the commenters' recommended minimum flow requirements for early May of Schedule 5 and 6 Years and Conference Years to address attraction of spring-run Chinook salmon into the lower Yuba River were effective, it would be contrary to the NMFS (2014) Recovery Plan objective of establishing an independent, viable spring-run Chinook salmon population in the lower Yuba River.

FERC should not make the commenters' recommended changes to YCWA's proposed Condition AR3 for higher minimum flows to address the "spring gap".

The CDFW, FWS and FWN rationale statements state that a "spring gap" exists in Project operations, which the USDOI Comment Letter describes as "*The time period in between high spring flows and delivery flows is commonly referred to as the "spring gap"* (USDOI letter, pg. 51). CDFW's rationale statement for its recommended Condition 2.5 states that the recommend condition includes requirements "to avoid a drop in flows prior to the end of the natural spring inundation period ('spring gap') (CDFW Comment letter, pg. 85). As shown in Table 2.5-1 above, the spring pulse component of the CDFW and FWS proposed 10(j) flow recommendations would require an increase of 400 cfs in Schedule 2 years and increases of 250 cfs (compared to YCWA's proposed Condition AR3) in the May 1-15 requirements for Schedule 3, 5 and 6 Years and

Conference Years. FERC should reject the CDFW, FWS and FWN proposals for additional flows to avoid the "spring gap" for the following reasons:

- CDFW, FWS and FWN include in their rationale statements for their recommended modifications to YCWA's Conditions AR3 the general desire for a "more natural hydrograph" and the natural hydrograph of the Yuba River includes a "spring gap". In wetter years, April precipitation is significantly less than in the months of February and March, resulting in substantially less runoff in April than earlier months. Spring snowmelt does not peak until mid to late May. The result is a significant reduction in runoff in the month of April compared to the February-March and May peaks from two different and temporally separate processes. In moderately wet years where precipitation has been heavy in the early to mid-winter resulting in significant runoff at that time and a moderate snowpack accumulation, the reduced natural runoff rate of April relative to the peak winter runoff from rainfall and the peak snowmelt of mid-May are even more pronounced. Accordingly, CDFW's, FWS's and FWN's recommendations for flows to avoid a "spring gap" are inconsistent with their other statements favoring a more-natural hydrograph.
- The CDFW, FWS, FWN recommended modifications to the AFLA Condition AR3 flows for Schedule 1 and 2 years have requirements for high spring flows in April that would be much earlier than normally would occur with the spring peak runoff in such years. The average peak flow of the natural hydrograph of the Yuba River in Schedule 1 and 2 years occurs in mid to late May. The need for May flows to avoid "spring gap" can be eliminated if FERC does not adopt the CDFW, FWS and FWN recommendations for higher April flows.
- CDFW uses an example of modeled flows for 1997 (CDFW Rationale Report pg. 119 Figure 3.4.8-22) to demonstrate the "spring gap" and "*where CDFW required flows increase springtime floodplain inundation*".

  However, CDFW's statement in the caption to this figure that its recommended flow regime would increase springtime floodplain inundation is incorrect. As shown by this figure, flows associated with CDFW's recommended flow regime would not exceed the bankfull flow of 5,000 cfs and, therefore, would not inundate the floodplain. Rather, they would just provide more flow within the channel.

  Moreover, what is not included in this figure is the modeled natural flow for that year. Figure AR3-7 below shows for the same time period the modeled flows at Marysville for the without-project scenario. This figure demonstrates that the "spring gap" is a characteristic of the natural hydrograph. Thus, CDFW's general goal of "a more natural hydrograph" should include a "spring gap" like the one that would have occurred during CDFW's example year.

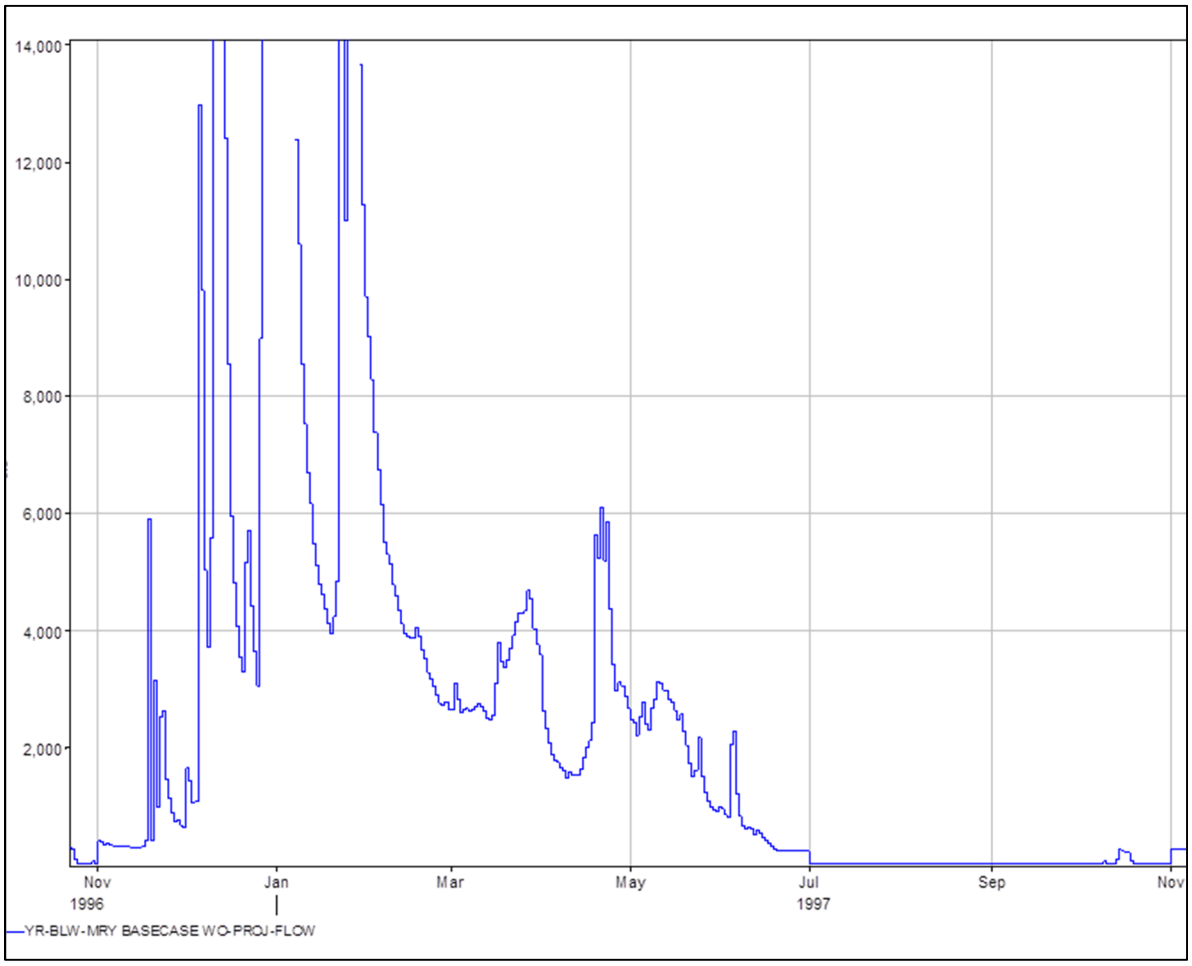

Figure AR3-7. Daily flow at the Marysville Gage for CDFW's referenced year (November 1996 to November 1997) demonstrating the "spring gap" that would have occurred under Without-Project conditions.

- USDOI's Comment Letter (pg. 18) states that "*As part of normal operations in wetter years, the Project spills frequently over Englebright dam. When spill has subsided, the YCWA 'gains control' of the project and begins to operate for water storage, and thus flows in the Lower Yuba River drop quickly as YCWA drops down to required minimum required stream flows. Minimum flow requirements govern the flows in the Lower Yuba River then until YCWA ramps up flows for water deliveries during summer months. The time period in between high spring flows and delivery flows is commonly referred to as the 'spring gap.' The spring gap dewaters juvenile salmonid habitat earlier than the recession period of the natural hydrograph.*"

  This statement is incorrect for several reasons.

  - First, YCWA has never heard of the term "spring gap", and thus it is not "commonly referred to", as stated by FWS.

- Second the FWS description of project operations as "*When spill has subsided, the YCWA "gains control" of the project and begins to operate for water storage, and thus flows in the Lower Yuba River drop quickly as YCWA drops down to required minimum required stream flows"* is not correct for the spring period after a spill has occurred at Englebright Dam. During wetter years, after a spill at Englebright Dam, and when all releases are made through the Narrows 2 and PG&E Narrows 1 powerhouses, releases are maintained at a level to manage uncontrolled inflow to Englebright Reservoir and releases from New Bullards Bar Reservoir to manage storage. During wetter years, minimum required flows of the Yuba Accord do not govern releases and significantly higher releases are made to manage natural runoff.
- Third, YCWA operates the Project for several purposes, including flood control. Implying that YCWA does not have control of project operations while Englebright Dam is spilling is incorrect and not appropriate.
- Fourth, the term "dewatering" here is incorrect, because it pertains to potential effects on anadromous salmonids redds and incubating embryos, not juvenile salmonid habitat.
- Fifth, the FWS statement has no evidence, data or analysis to support its statement that a "*spring gap dewaters juvenile salmonids habitat*" in the lower Yuba River.

1.5.3 Scenario AR3b – Commenters' Proposed Winter Pulse Flows (Winter Pulse Only) (FWS_CDFW_FWN -AR3b)

CDFW's FWS's, BLM's, and FWN's recommended changes to YCWA's proposed Condition AR3 all include a winter pulse flow component. The biological objectives for the winter pulse flow component state that the purposes of the conditional winter pulses in the drier water years are to:

(1) trigger upstream migration of adult steelhead; and

(2) provide a cue for outmigration of juvenile spring-run Chinook salmon.

The commenters' recommended winter pulse flow component states that if between December 1 and February 1 in Schedule 5, 6, and Conference WYs flows greater than 3,000 cfs, as measured at the Smartsville – USGS Streamflow Gage 11418000 do not occur for at least two consecutive days, then Licensee would be required to implement the proposed conditional winter pulse flows.

FERC should not make the commenters' recommended changes to YCWA's proposed Condition AR3 for conditional winter pulses in Schedule 5 and 6 Years and Conference Years.

Adult Steelhead Upstream Migration Issues

YCWA asked FERC for a variance of the lower Yuba River minimum flow requirements in YCWA's current FERC license for the Smartsville Gage from December 1, 2015 through March 31, 2016 because of low reservoir storage and severe drought conditions. While not required by

the December 30, 2016 FERC Order responding to YCWA's request, it was agreed (at a January 15, 2016 meeting) that the Lower Yuba River VAKI Riverwatcher™ Steelhead Passage Monitoring Report (YCWA 2015), which was filed with FERC on May 29, 2015, would be updated to include 2016 data. YCWA submitted the updated report to FERC on August 25, 2016 (incorporated by reference, herein). The following information was obtained from that report, which analyzed steelhead passage information through the VAKI Riverwatcher™ system located at Daguerre Point Dam for 13 years of available data extending from 2003/2004 through 2015/2016 (the 2015/2016 season was only evaluated through June 13, 2016, corresponding to the period of data availability).

YCWA's August 25, 2016 report took a comprehensive approach to evaluate adult steelhead upstream passage and pulse flows. The comprehensive approach included three major components.

- Empirical Data Period of Record. The VAKI Riverwatcher™ systems at Daguerre Point Dam were partially operational or completely non-operational during several months each year of sampling before 2010/2011. Although improvements to the system have been made over time, it was not until the most recent system improvements were implemented during the 2010/2011 sampling season that the system began demonstrating sustained reliability in the documentation of steelhead passing upstream of Daguerre Point Dam, over a range of environmental conditions. Although not reliably representative of the total annual number of adult steelhead passing upstream of Daguerre Point Dam, data from years before 2010/2011 were included in the evaluation and examined to attempt to distinguish potential relationships between upstream passage and flows during periods when the VAKI Riverwatcher™ systems were at least partially operational.
- Daily and Sub-daily Flow Evaluations. For each of the 13 years included in the analysis, the number of adult steelhead passing upstream through Daguerre Pont Dam was plotted and compared with average daily flows occurring prior, during and subsequent to observed passage. Passage was noted as occurring during ascending, descending or stable periods of the hydrograph.

  A more detailed evaluation was conducted for each period of time when a potential relationship between a pulse flow and upstream passage of adult steelhead was discernable, including compiling and displaying adult steelhead data for the four, 6-hour diel periods of each day before, during and after the pulse flow along with hourly flows. If the general pattern of daily counts of adult steelhead passing upstream of Daguerre Point Dam did not notably change during or within several days after a pulse flow compared to the days prior to the pulse flow (no discernable relationship between the pulse flow and upstream passage of steelhead), no additional analysis was conducted.
- Confirmed Steelhead in Addition to "unidentified" Fish. YCWA (2016) conducted two analyses of sub-daily VAKI Riverwatcher™ data during pulse flow events. The first analysis included VAKI Riverwatcher™ data for O. mykiss greater than or equal to about 16 inches (40 cm) in total length. The second analysis included VAKI Riverwatcher™ data for O. mykiss and "unidentified" fish greater than or equal to about 16 inches in total length. It is recognized that the second analysis may be including fish other than steelhead, but this analysis was conducted to attempt to gain additional general insight to possible

movements-flow relationships, and to avoid the potential for excluding steelhead that were not identified in the VAKI Riverwatcher™ systems. Analyses were conducted for the following flow events.

- December 21, 2007
- February 3, 2008
- February 25, 2008
- October 25, 2010
- December 7, 2010
- January 23, 2012
- February 10, 2014
- March 6, 2014
- December 5 and 12, 2014
- February 11, 2015
- December 23, 2015
- January 7 and 18, 2016
- January 24 and 30, 2016

1.5.3.1 The commenters' recommendation and rationale statements do not provide substantial evidence regarding the need for winter pulse flows to facilitate adult steelhead upstream passage. Empirical data of adult steelhead upstream passage at Daguerre Point Dam and associated flows demonstrate that a winter pulse flow is not needed to provide adult steelhead upstream passage in the lower Yuba River.

The commenters provided no data, evaluations or information demonstrating that adult steelhead upstream passage is impeded or in need of "improvement" in the lower Yuba River – either for the full suite of flows that have occurred, or for flows associated with "drier" years (Schedule 5, 6 and Conference Years).

In contrast, YCWA's August 25, 2016 report to FERC demonstrated that, based upon 13 years of empirical data, adult steelhead upstream passage through Daguerre Point Dam has occurred during a variety of flow conditions – including ascending hydrographs, descending hydrographs, and extended periods of stable flow conditions – and during "drier" conditions.
The commenters propose that their recommended measure be implemented during in Schedule 5, 6 and Conference Years, during the first week of February (February 1 – 6) if between December 1 and February 1 flows greater than 3,000 cfs as measured at the Smartsville Gage do not occur for at least two consecutive days. Under YCWA's proposed Condition AR3, the minimum flow requirements for February in these water years are 550, 550 and 500 cfs at the Smartsville Gage, and 500, 350 and 350 cfs at the Marysville Gage. As reported by YCWA (2016), empirical data from the lower Yuba River demonstrates that in over one-half of the years for which information is available, flows far less than 1,000 cfs have occurred for several months before January. During those years, the vast majority of adult steelhead observed passed upstream of Daguerre Point Dam at relatively stable flows ranging from about 400 to 600 cfs at the Marysville Gage. These observations indicate that adult steelhead upstream passage has occurred at flows approaching the Condition AR3 minimum flow requirements for Schedule 5, 6 and Conference Years.

In an attempt to justify CDFW's recommendation for a winter pulse flow, CDFW's rationale statement states "*In 2015, YCWA conducted VAKI RiverwatcherTM steelhead passage monitoring*

on the lower Yuba River from December 1, 2014 to March 31, 2015. The purpose of the monitoring was to evaluate potential relationships between pulse flows and upstream passage of adult steelhead at Daguerre Point Dam. The result of this study indicated a relationship between steelhead passage at Daguerre Point Dam in response to ecological functions of a pulse flow (Figure 3.4.8-3 and Figure 3.4.8-4). These findings are consistent with a classic California study that linked "large increases in stream flow" with "heavy upstream migrations" of adult steelhead in a coastal watershed (Shapovalov and Taft 1954)…" (CDFW letter, pg. 98 (emphasis added)).

There are several reasons why this CDFW rationale does not actually support the commenters' winter pulse flow recommendation.

1) CDFW's statement refers to the report submitted by YCWA to FERC on May 29, 2015, rather than the updated report submitted by YCWA to FERC on August 25, 2016. CDFW should have considered the additional data and information that were included in the updated report.
2) CDFW's statement that ….*The result of this study indicated a relationship between steelhead passage at Daguerre Point Dam in response to ecological functions of a pulse flow (Figure 3.4.8-3 and Figure 3.4.8-4)"* is an incorrect representation of the findings of the YCWA May 29, 2015 report. As stated in the YCWA August 25, 2016 report, which included the same findings as the YCWA May 29, 2015 report, supported by additional data:

    - During most years, steelhead passed upstream of Daguerre Point Dam when flows were relatively stable, or gradually increasing or decreasing, and these flows were not associated with any pulse flow event.
    - Although a few naturally occurring pulse flows in the record were observed that coincided with an influx of adult steelhead passage at Daguerre Point Dam, many more instances were observed of adult passage without any corresponding pulse flow, or where there was a pulse flow without a corresponding increase in adult passage.
    - No consistent, discernable trend relating pulse flow events and increased passage of adult steelhead at Daguerre Point Dam was observed through examination of the VAKI Riverwatcher™ data from January 2004 through June 2016. It therefore is questionable whether a regulated flow release could be used as an effective management tool to stimulate adult steelhead upstream passage in the lower Yuba River.

      Also, CDFW's rationale statement refers to only two monthly periods from the 2014 monitoring period, and the data CDFW relies on are not for identified steelhead, but only for "unidentified fish". CDFW's statement ignores available data from all of the other years, and these data do not support CDFW's contention.

3) CDFW's statement that …." *These findings are consistent with a classic California study that linked "large increases in stream flow" with "heavy upstream migrations" of adult*

steelhead in a coastal watershed (Shapovalov and Taft 1954) is based on an inappropriate reference.

Although Shapovalov and Taft (1954) addressed steelhead in a coastal California stream, stream conditions in that stream were very different from those in the lower Yuba River. The CDFW rationale states that "*In a classic California study, Shapovalov and Taft (1954) linked "large increases in stream flow" with "heavy upstream migrations" of adult steelhead in a coastal watershed*." This is not an entirely accurate characterization of the author's statement. The actual statement (on p. 142 of the Shapovalov and Taft report) regarding steelhead upstream migration is "*…in certain streams entry and upstream migration may necessarily be delayed by physical conditions. In many streams the first heavy upstream migrations coincide with large increases in stream flow, especially in streams which attain low summer levels, but such migrations often do not occur with the first large increases in stream flow*."

In fact, Shapovalov and Taft (1954) stated that steelhead "*…tend to remain "holed up" until a change of weather occurs, in which case even a light rain and small rise in stream level will cause a large number to ascend the stream or spawn below the pool in which they had waited*." Clearly, CDFW's reliance on a small coastal stream to support its recommendation for a large Central Valley river such as the lower Yuba River is problematic.

1.5.3.2 The commenters' recommendation and rationale statements do not establish a relationship between pulse flows of the recommended magnitudes and adult steelhead upstream passage rates.

As described above, YCWA's August 25, 2016 report to FERC demonstrates that, based upon 13 years of empirical data, adult steelhead upstream passage through Daguerre Point Dam has occurred during a variety of flow conditions, over a range of flow levels. Adult steelhead passage has been frequently observed at Daguerre Point Dam during relatively stable flows that were much lower than the commenters' recommended 3,000 cfs.

Therefore, considering an analysis of the entire available data set, there is no substantial evidence to support the conclusion that a winter pulse flow ranging from 2,745 cfs to 3,000 cfs (for Conference Years and Schedule 5 Years, respectively) is necessary for, or would increase, adult steelhead upstream passage.

The commenters have not provided any data to support their proposal for peak pulse flows of 2,745 cfs to 3,000 cfs, rather than some different flows. The commenters also have not provided any evidence or logical scientific argument that a duration of two consecutive days for the peak release would be appropriate.

Moreover, the commenters' recommended winter pulse flow measure would be problematic to implement. The B-120 bulletins do not come out until approximately February 10 each year. Consequently, a determination as to whether the current water year is a Schedule 5 or 6 Year or a

Conference Year would be dependent upon the last B-120 of the previous year (typically issued in May), and thus may not be reflective of actual water year type conditions in the present year.

1.5.3.3 The commenters' recommendation and rationale statements do not acknowledge or consider the potential for re-directed impacts to steelhead in the lower Yuba River.

The commenters' recommended "pulse flow release" could result in unintended adverse consequences to steelhead in the lower Yuba River.

- A pulse flow release would provide the potential for steelhead redds constructed during the higher flow conditions to become dewatered when flows are reduced after the pulse event.

- If a pulse flow actually were to attract steelhead, then it might simply be attracting Feather River Fish Hatchery steelhead from the lower Feather River into the lower Yuba River, given that for the last three years of available VAKI Riverwatcher data, 43, 63 and 42 percent of all steelhead passing through Daguerre Point Dam were adipose fin-clipped, indicating hatchery origin (YRDP 2014 BA).

1.5.3.4 The commenters' proposal improperly relies on the NMFS 2014 Final Recovery Plan.

CDFW's rationale statement for winter pulse flows (CDFW letter, pg. 98 states …"*the Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-run Chinook Salmon and Central Valley Spring-run Chinook Salmon and the Distinct Population Segment of California Central Valley Steelhead (NMFS 2014) identifies implementing pulse flows for the benefit of adult steelhead immigration as a recovery action for the Feather River and five other regulated Central Valley watersheds. For the Feather River, of which the Yuba River is a tributary, this action specifically is to be implemented "during peak migration periods for years with low water availability" (NMFS 2014*).

This CDFW statement is misleading. NMFS (2014, pp. 249-250) actually states "*Evaluate pulse flow benefits in the Feather River for adult immigration and juvenile outmigration during peak migration periods for years with low water availability; if pulse flows are determined to be effective for attracting adult spring-run Chinook salmon and steelhead or for improving survival during juvenile outmigration, implement the most beneficial pulse flow regime*."

Thus, CDFW's letter attempts support pulse flows for attraction of adult steelhead in the lower Yuba River by referring to recovery actions in NMFS (2014) for the lower Feather River and other rivers. If anything, this statement does not support CDFW's proposal, because NMFS 2014 does not identify pulse flows as a recovery action for adult steelhead attraction in the lower Yuba River.

Moreover, CDFW's statement suggests that NMFS 2014 implies that pulse flows should be implemented, while NMFS (2014) actually emphasizes evaluation of potential pulse flows and a determination of their effectiveness before implementing them. Moreover, NMFS (2014) does not state that pulse flows should be implemented during peak migration periods for years with low

water availability. It actually states that the evaluation should occur during years with low water availability.

The commenters' recommended changes to AR3 for conditional winter pulse flows in drier years (scenario AR3b) would not accomplish their stated objective of providing a cue for outmigration of juvenile spring-run Chinook salmon.

1.5.3.5 The commenters' rationale statements do not provide substantial evidence regarding the need for pulse flows to facilitate outmigration of juvenile spring-run Chinook salmon.

RMT (2013) examined 9 years of Rotary Screw Trap data collected in the lower Yuba at a downstream location (near Hallwood Boulevard) (Figure AR3-8). The RMT reported:

- Juvenile Chinook salmon generally emigrate at flows of less than 2,000 cfs during most years (based on mean weekly flow at Marysville Gage).
- Emigration occurs at relatively stable flows of about 1,000 cfs or less (e.g., WY 2000, 2001 and 2009).
- An increase in emigration occurred during some peak events (3,500-4,500 cfs) (e.g., WY 2007).
- There was no consistent trend between emigration and pulse flows.

For the years of year-round sampling, RMT (2013) provided the following observations:

- 2006-2007
  - Fish passed nearly every week of the water year.
- 2007-2008
  - Fish passed during nearly all weeks of the water year, generally at flows of less than 1,000 cfs.
  - A large mode of fish was observed passing from late April through August at flows of ~700 to 1,000 cfs.
- 2008-2009
  - Fish passed during most weeks of the water year.
  - A large mode of fish passed from June through August after flows decreased from about 4,500 cfs in late May to about 1,700 to 2,200 cfs in early June through August.

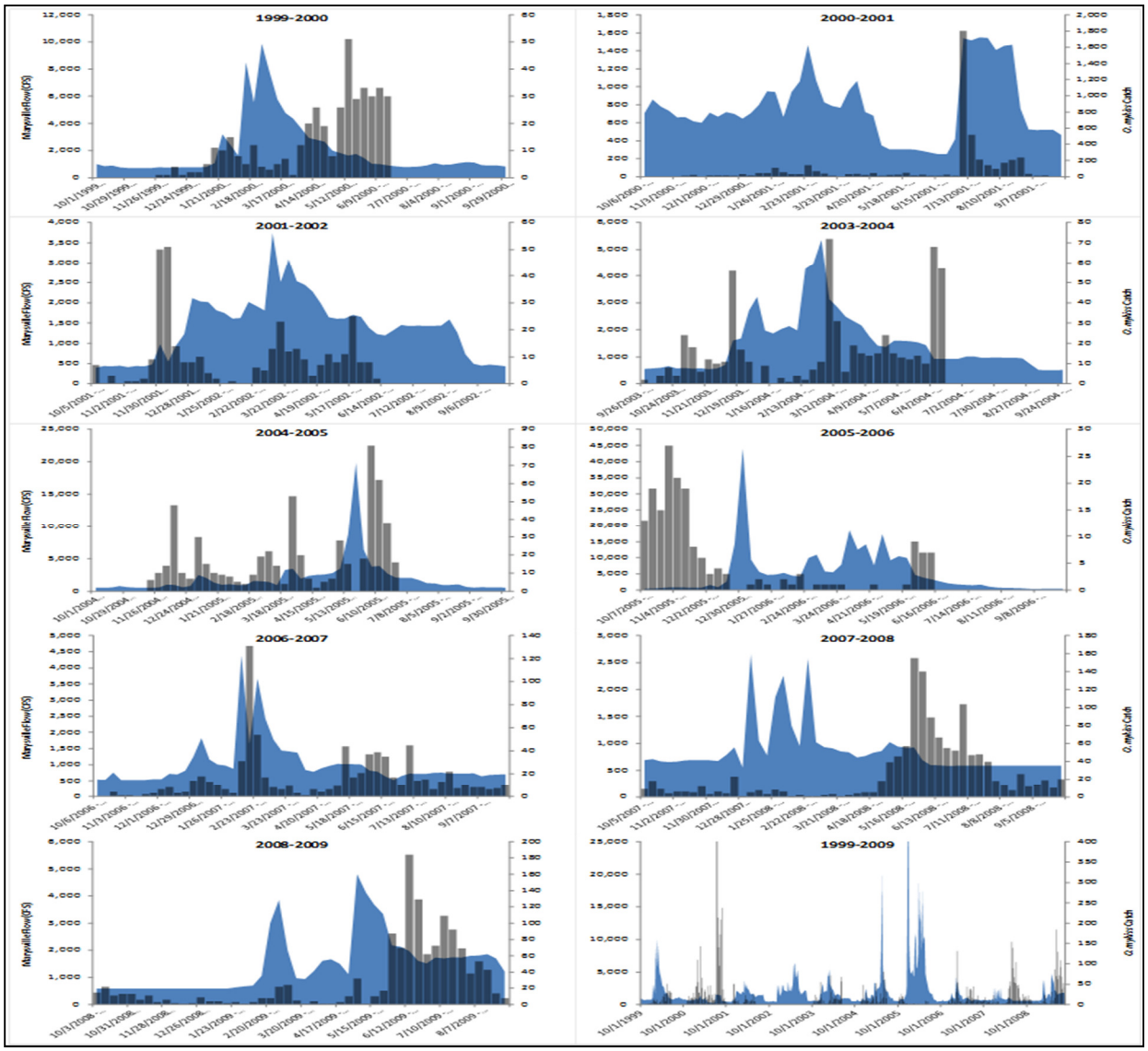

Figure AR3-8. Mean weekly flow (blue shading) at the Marysville Gage and Chinook salmon catch (gray bars) for each annual survey at the Hallwood Boulevard RST site on the lower Yuba River from October 1, 1999 to August 31, 2009 (from RMT 2013).

None of the commenters' rationale statements for proposed revisions to YCWA's proposed Condition AR3b provides any data, analyses or information indicating that outmigration of juvenile spring-run Chinook salmon in the Yuba River is a problem. Moreover, no information was presented that substantiated or supported the commenters' recommendation for a winter pulse flow to facilitate such outmigration.

1.5.3.6 The commenters' rationale statements do not establish a relationship between the proposed pulse flows and juvenile Chinook salmon outmigration rates.

The commenters have not provided any data or information demonstrating that their recommended flows would have any effects on juvenile salmonid outmigration. In fact, the above information indicates that juvenile Chinook salmon downstream passage has occurred at river flows much lower than those recommended by the commenters for winter pulse flows.

1.5.3.7 The commenters' recommendation and rationale statements do not acknowledge or consider the potential for re-directed impacts to juvenile spring-run Chinook salmon associated with downstream displacement.

A pulse flow could induce non-volitional downstream transport of juvenile salmonids, particularly because the time for the proposed pulse flows (early February) is after nearly all spring-run Chinook salmon embryo incubation and fry emergence occurs, and weak-swimming post-emergent spring-run Chinook salmon fry are in the river. Previous RST monitoring (YCWA 2001 data) has demonstrated a large increase in captured juvenile steelhead associated with a rapid increase in flow resulting from a managed release for a water transfer.

During the development of the Yuba Accord flow schedules, CDFW, NMFS and FWS representatives all expressed concerns regarding the downstream movement of juvenile salmonids due to increases in instream flows. The potential movement of juvenile salmonids over Daguerre Point Dam could restrict subsequent rearing to river reaches downstream of Daguerre Point Dam, because juvenile salmonids cannot readily pass back upstream of Daguerre Point Dam. Consequently, they may not be able to as successfully have extended (year-round) rearing in the lower portion of the river due to increased water temperatures and abundance of predators.

As described in CDFW's Rationale Report (pg. 102) in support of their recommended spring flows, CDFW states that juvenile salmonids that leave the system at small sizes have reduced chances of surviving outmigration. By early February, spring-run Chinook salmon fry and juveniles are rearing in the lower Yuba River at relatively small sizes. It is somewhat contradictory for the commenters to recommend high spring flows to promote juvenile salmonid growth and higher survival, while at the same time recommending a winter pulse flow to flush small juvenile salmonids downstream. Moreover, it is unlikely that large juveniles would benefit from a February pulse flow, because larger juveniles (70-140 mm) were observed emigrating from the lower Yuba River primarily during October through January (RMT 2013; Massa 2005; Massa and McKibbin 2005).

1.5.4 AR3 - Maintain Minimum Streamflows at Narrows 2 Powerhouse and Narrows 2 Full Bypass (Minimum Flow + Winter Pulse)

All of YCWA's responses to the commenters' recommendations for scenarios AR3a and AR3b that are discussed above also pertain here to scenario AR3, which is the combination of scenarios AR3a and AR3b. These responses are not repeated here. This section of this report discusses the results of the additional modeling that was conducted to compare YCWA's proposed Condition

AR3, the commenters' recommended changes to this proposed condition, and the Base Case, to determine the estimated amounts of juvenile salmonid rearing habitat for each scenario.

1.5.4.1 The commenters' recommendation would not substantially increase the amounts of estimated juvenile salmonid rearing habitat (WUA) during the spring period.

YCWA conducted modeling for this response, comparing YCWA's AFLA Condition AR3, the commenters' recommended revisions to Condition AR3, and the Base Case (see "Attachment AR3 – Model Output and Evaluation"). Results of these comparisons demonstrate that the commenters' recommendation would not substantially increase the amount of estimated juvenile salmonid rearing habitat (WUA) during the spring period. In fact, there are no substantive differences in estimated fry or juvenile rearing habitat for spring-run Chinook salmon, fall-run Chinook salmon, or steelhead for the spring under the commenters' recommended revisions to Condition AR3, relative to the scenarios for YCWA's AFLA Condition AR3 and the Base Case.

Spring-run Chinook Salmon

YCWA's modeling estimated spring-run Chinook salmon juvenile rearing habitat (WUA in sq ft), using the agreed-upon Relicensing Participants HSC with cover specified in TM 7.10, for the scenarios for the Base Case, YCWA's AFLA Condition AR3, and the commenters' recommended changes to Condition AR3 for the March 1 through May 31 portion of the juvenile rearing period.

- As shown in Figure AR3-9, estimated amounts of juvenile spring-run Chinook salmon rearing habitat are essentially identical for all three scenarios for all probabilities of exceedance.

Fall-run Chinook Salmon

YCWA estimated fall-run Chinook salmon fry rearing habitat (WUA in sq ft), using the agreed-upon Relicensing Participants HSC with cover specified in TM 7.10, for the scenarios for the Base Case, YCWA's AFLA Condition AR3 and the commenters' recommended changes to Condition AR3 for the March 1 through April 30 portion of the fry rearing period.

- As shown in Figure AR3-10, estimated amounts of fall-run Chinook salmon fry rearing habitat are essentially identical for all three scenarios for all probabilities of exceedance.

  YCWA estimated fall-run Chinook salmon juvenile rearing habitat (WUA in sq ft), using the agreed-upon Relicensing Participants HSC with cover specified in TM 7.10 for the scenarios for the Base Case, YCWA's AFLA Condition AR3 and the commenters' recommended changes to Condition AR3 for the March 1 through May 31 portion of the juvenile rearing time period.

- As shown in Figure AR3-11, estimated amounts of juvenile fall-run Chinook salmon rearing habitat are essentially identical for all three scenarios over the entire distribution.

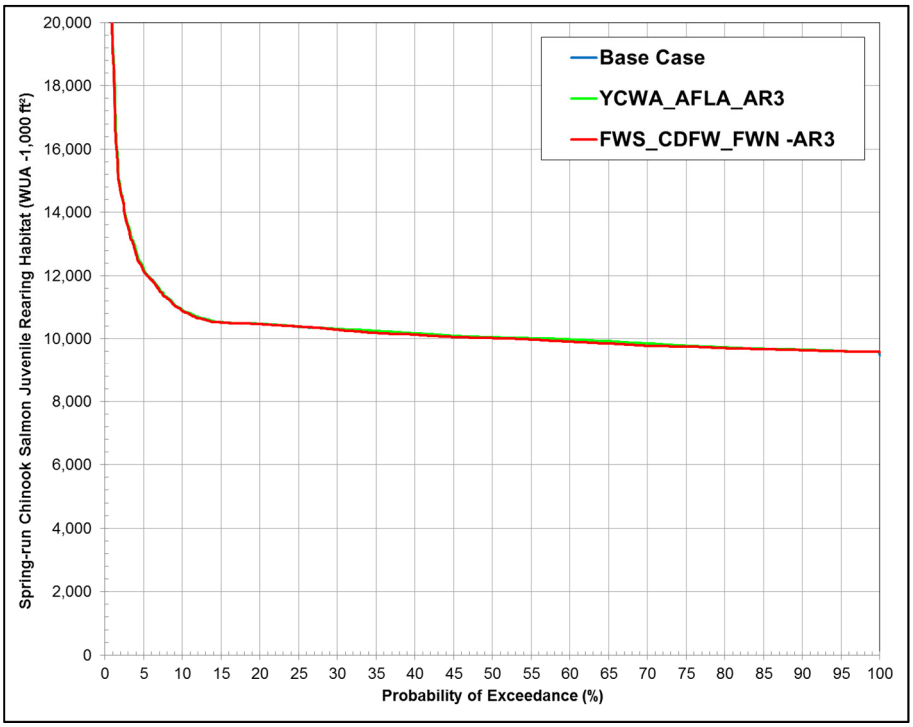

Figure AR3-9. Spring-run Chinook salmon juvenile rearing habitat duration over the 41-year hydrologic period during the March 1 through May 31 portion of the lifestage for the Base Case, YCWA_AFLA_AR3, and FWS_CDFW_FWN –AR3 scenarios.

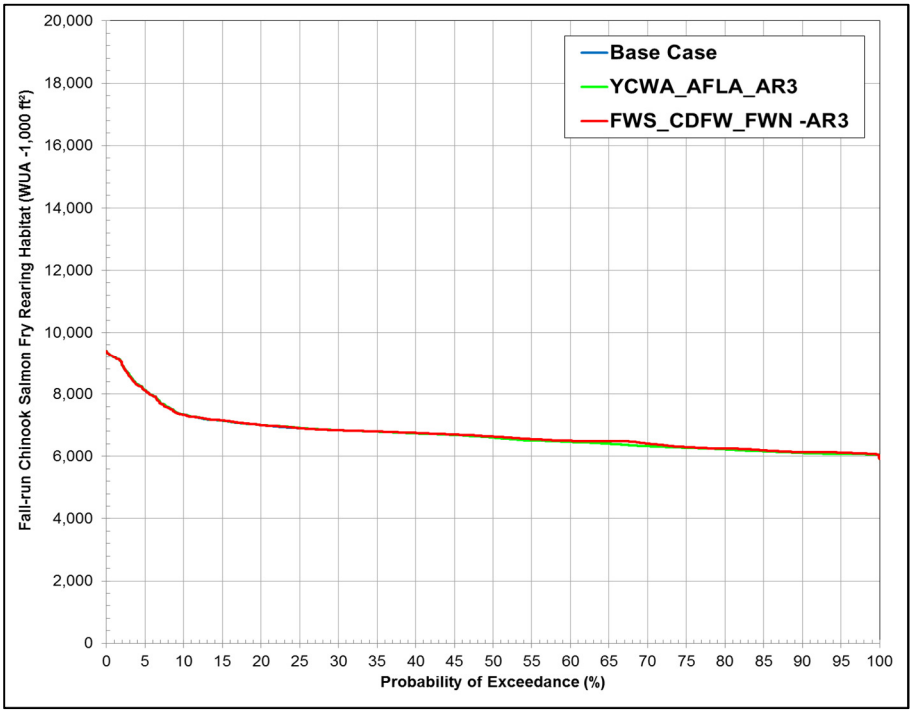

Figure AR3-10. Fall-run Chinook salmon fry rearing habitat duration over the 41-year hydrologic period during the March 1 through April 30 portion of the lifestage for the Base Case, YCWA_AFLA_AR3, and FWS_CDFW_FWN –AR3 scenarios.

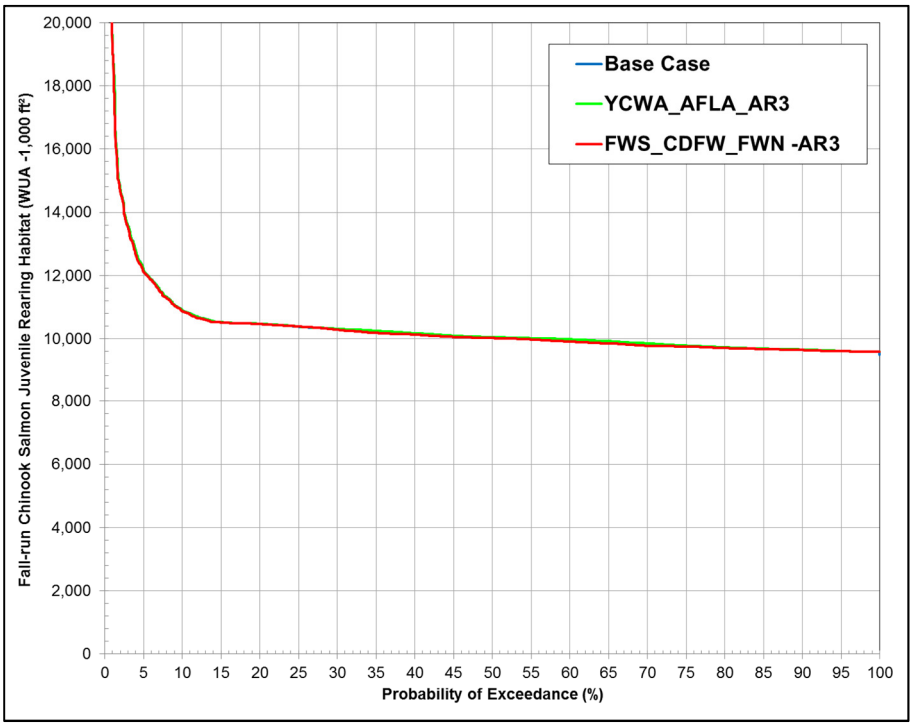

Figure AR3-11. Fall-run Chinook salmon juvenile rearing habitat duration over the 41-year hydrologic period during the March 1 through May 31 portion of the lifestage for the Base Case, YCWA_AFLA_AR3, and FWS_CDFW_FWN –AR3 scenarios.

Steelhead

YCWA estimated steelhead fry rearing habitat (WUA in sq ft), using the agreed-upon Relicensing Participants HSC with cover specified in TM 7.10, for the scenarios for the Base Case, YCWA's AFLA Condition AR3, and the commenters' recommended changes to Condition AR3 for the April 1 through May 31 portion of the fry rearing period.

- As shown in Figure AR3-12, estimated amounts of steelhead fry rearing habitat are essentially identical for all three scenarios over the entire distribution.

YCWA estimated steelhead juvenile rearing habitat (WUA in sq ft), using the agreed-upon Relicensing Participants HSC with cover specified in TM 7.10, for the scenarios for the Base Case, YCWA's AFLA Condition AR3, and the commenters' recommended changes to Condition AR3 for the March 1 through May 31 portion of the juvenile rearing period.

- As shown in Figure AR3-13, estimated amounts of juvenile steelhead rearing habitat are essentially identical for all three scenarios over the entire distribution.

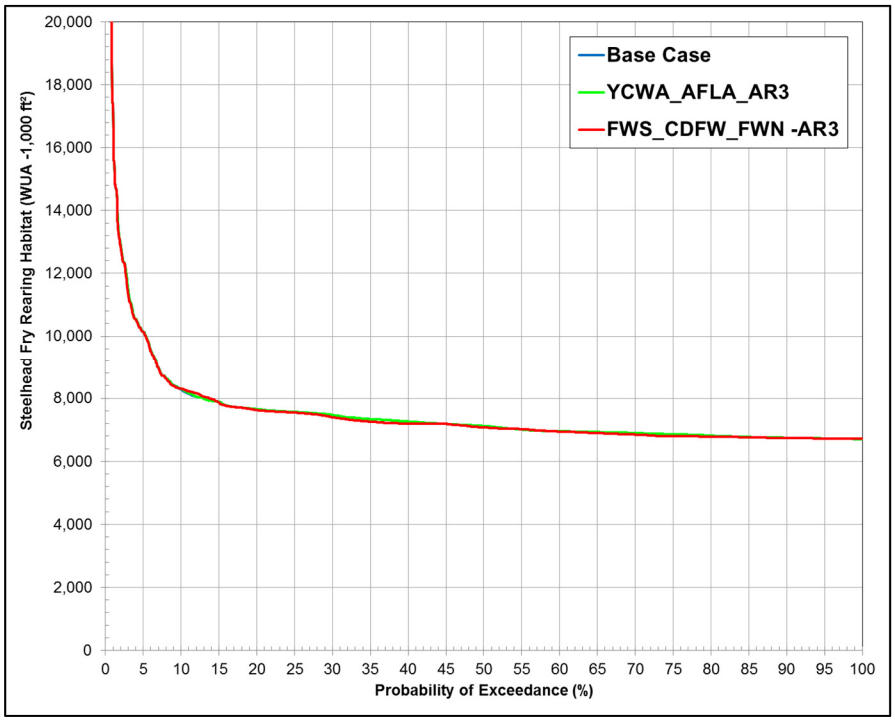

Figure AR3-12. Steelhead fry rearing habitat duration over the 41-year hydrologic period during the April 1 through May 31 portion of the lifestage for the Base Case, YCWA_AFLA_AR3, and FWS_CDFW_FWN –AR3 scenarios.

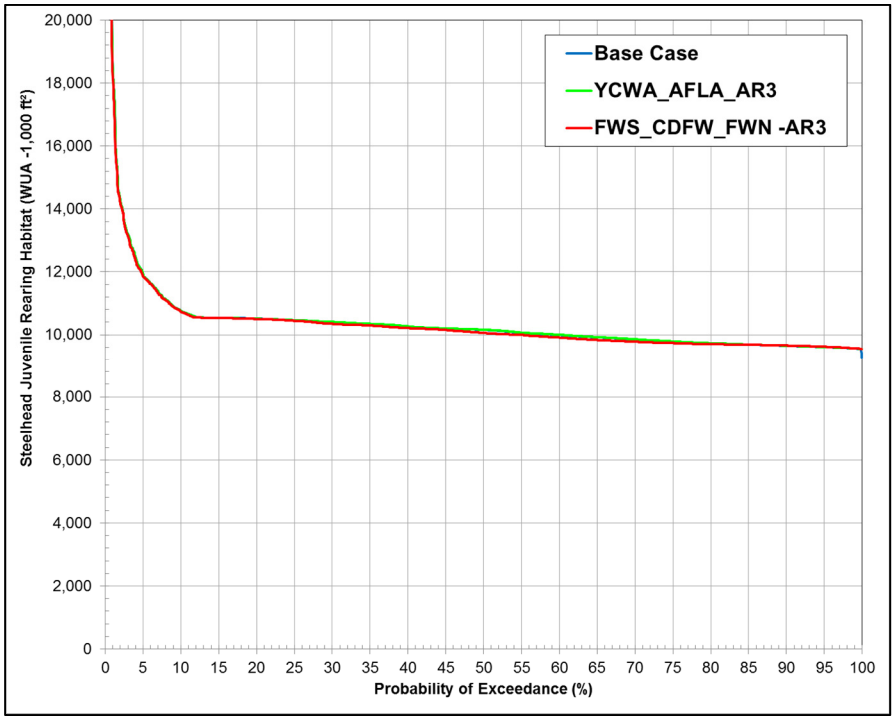

Figure AR3-13. Steelhead juvenile rearing habitat duration over the 41-year hydrologic period during the March 1 through May 31 portion of the lifestage for the Base Case, YCWA_AFLA_AR3, and FWS_CDFW_FWN –AR3 scenarios.

1.5.4.2 The commenters' recommended changes to YCWA's proposed Condition AR3 would result in significant costs in terms of reduced operational flexibility, reduced water transfers and reduced revenue generation.

If FERC were to adopt the CDFW, FWS, FWN recommended changes to YCWA's Condition AR3, then YCWA would have to conduct extreme Project operations in some years to comply with the required flows at Marysville Gage, and these operations would result in water delivery shortages to local farmers in some wetter water years and would significantly reduce the water supply reliability for farmers and farm operations in some years. The commenters' recommended changes to YCWA's Condition AR3 would significantly reduce, and in some years would eliminate, YCWA water transfers and associated transfer revenues, and would impact YCWA's power generation revenues. The most significant impacts to YCWA's mission and YRDP operations that would result from the CDFW, FWS, and FWN recommended changes to YCWA's Condition AR3 are:

- Extreme and unconventional Project operations would be required in some years because the release capacity of YCWA's Narrows 2 Powerhouse is about 3,400 cfs, which is 100 cfs less than the commenters' recommended required minimum flow of 3,500 cfs at Marysville Gage from March 23 to April 30 for f Schedule 1 years. YCWA has a coordinated operations agreement with PG&E for operations of the Narrows 1 Powerhouse, but that agreement does not mean that the Narrows 1 powerhouse always would be available to help meet a 3,500 cfs flow requirement.
- In addition, eight YCWA Member Units divert water upstream of Daguerre Point Dam at rates up to 1,000 cfs during April. If Member Units were to divert 1,000 cfs, then the net flow at the Marysville Gage would be a maximum of 2,400 cfs if Narrows 1 were not available for additional releases. YCWA has contracts with the Member Units and YCWA could require some of the Member Units to stop diverting water under these circumstances, but three of those Member Units have their own water rights and could decide to continue to divert water under their own rights. Limiting diversions to some or all of the Member Units would have large impacts to farmer operations and economics. Water Balance/Operations modeling results for scenario FWS_CDFW_FWN -AR3a that includes the commenters' recommended changes to YCWA's Condition AR3 show that in two of the years when these recommended flows would result in irrigation diversion shortages that are not present in the Base Case, additional diversion shortages would occur if the Narrows 1 Powerhouse were not available. For April of 1970 and 2004 when 3,500 cfs would be required in April, all diversions in the last week of the month would have to cease for YCWA to comply with the commenters' proposed changes. This type of shortage would occur in 5 additional Schedule 1 years for a total of 7 of 19 Schedule 1 years in the period of simulation.
- The only remaining option for YCWA would be to release enough water from New Bullards Bar Reservoir to force a spill at Englebright Dam to provide enough flow to meet the recommended Marysville required flow of 3,500 cfs. Releases would have to be made through the Colgate Powerhouse (3,400 cfs capacity) and augmented with either spills at New Bullards Bar Reservoir through the spillway gates, or through the New Bullards Bar Reservoir low level outlet. In either case, forcing spill at Englebright Dam by making

releases from New Bullards Bar Reservoir, which is located about 35 miles upstream of the Marysville Gage, would be required. Spilling of Englebright Dam would eliminate the peaking and ancillary services capacity of New Colgate Powerhouse during this operation due to the proposed license flow fluctuation limitations in YCWA's Proposed Condition AR9. The operation would also result in the loss of power generation because some of the water from New Bullards Bar Reservoir would be released through non-generating outlets.

Water delivery shortages would occur in wetter years when a large snowpack did not develop due to warmer than normal winter rains that otherwise would have provided high spring flows from snowmelt. Modeling results show that under the Base Case and AFLA Condition AR3 scenarios, shortages would occur in one very dry year (1977). With the CDFW, FWS, and FWN recommended modifications to YCWA's Condition AR3, additional water delivery shortages would occur in 1970, 1997, 2004 and 2007, which are Schedule 1, 1, 1, and 2 Years, respectively. Each of these years is characterized by lower than normal spring runoff with April to July unimpaired flows of less than 65 percent of average.

- Water supply shortages that would occur with the commenter's recommended changes to YCWA's Condition AR3 would have significant costs to YCWA and to local farmers. YCWA has conjunctive use agreements with its Member Units. Those agreements include a provision specifying that YCWA will pay the groundwater pumping costs to Member Units that have supplemental water supplies in their water supply agreements and who must pump groundwater to replace shortages in surface water deliveries. Any additional shortages in irrigation deliveries above the amounts of supplemental water supplies would be a direct pumping cost for Member Units and individual farmers that would not be reimbursed. In the recent drought of 2015, YCWA reimbursed Member Units at the rate of $35/acre-ft for groundwater pumping to make up for surface water delivery shortages. This is the cost to YCWA for shortages. The results of model scenario "CDFW_FWS_FWN_AR3", which models the commenters' recommended changes to YCWA's Condition AR3, when compared to the Base Case scenario estimates an increase of 4,020 acre-ft in the average annual shortage, with an average annual cost of $145,000 per year and a maximum single year cost of $2.7 million.

  Implementation of the commenters' recommended changes to YCWA's Condition AR3 would result in even more frequent shortages than those shown by the modeling. This is because water supply allocations are made in April and use a 90 percent exceedance forecast for future runoff conditions to ensure sufficient water supply is available to farmers as decisions related to crop planting are made. An updated forecast of water supply is made in May, but this is usually too late for summer cropping decisions. An April forecast of water supply together with a forecast of 90 percent future runoff would result in forecasting more frequent and larger shortages than those shown in the modeling results. The water supply planning implications of having shortages in wet years mean that drought planning no longer would be associated solely with dry conditions. Instead, water supply shortages could occur in a wide range of hydrologic conditions, even during wet water years.

- The CDFW, FWS, and FWN recommended changes to YCWA's Condition AR3 would result in significant reductions in, and in some years elimination of, Yuba Accord water transfers and associated revenues. The CDFW, FWS, and FWN recommended changes to

YCWA's Condition AR3 would have two types of impacts to Yuba Accord water transfers. First, the recommended high spring flows would be larger than the Yuba Accord spring flow requirements from the end of March through April 30 in Schedule 1 years and April 1 through May 15 in Schedule 2 years. The Yuba Accord flow requirements create the mechanism that produces water transfer flows in the Yuba River during the drier times of most years. Because the commenters' recommended changes to the flow requirements are higher than the Accord flow requirements, the resultant higher flows would override the transfer flows of the Yuba Accord. During the past 10 years, 6 percent and 9 percent of Accord surface water transfer releases have occurred during April and May, respectively, and almost all of this water would no longer be available for transfer with the commenters' recommended changes to YCWA's Condition AR3. Second, because these requirements would require large amounts of water to be released during the spring, less water would be available for transfers during summer.

In about 60 percent of years, Accord transfer releases are made from storage in New Bullards Bar Reservoir during the summer, and result in lower Yuba River flows that are higher than the Yuba Accord's instream flow requirements. Examination of the actual transfers that occurred in 2009, 2010, and 2016 indicates that the CDFW, FWS, FWN recommended changes to YCWA's Condition AR3 would have been implemented in those years, and, as a result, the summertime transfer volumes in those years would have been reduced by between 20 and 50 TAF.

An example of the impacts of the commenters' recommended changes to YCWA's Condition AR3 on water transfers can be demonstrated by examining what would have occurred in 2013 and 2014 if these recommended changes flows had been in effect. A comparison of the commenters' recommended flows versus the actual flows in spring 2013 is shown in Figure AR3-14. This figure shows that in 2013, the commenters' recommended changes would have overridden all of the surface water transfer flows for April and the first half of May, and would have required much larger releases during these months. In addition, if YCWA had been required to comply with the recommended flows:

- In 2013, there likely would have been water supply shortages in the irrigation season (whereas only fall rice field flooding shortages occurred in 2013 with the Yuba Accord flow requirements in effect). The surface water transfer volume would have been reduced by about 25,000 acre-ft. At the prices in the YCWA-DWR Water Purchase Agreement, the resulting loss of revenue to YCWA would have been $2.5 million.

- In 2014, almost all of the surface water transfer and groundwater substitution transfer amount (which totaled 162,000 AF) would have been eliminated. Using the transfer water prices for transfer surface water in the YCWA-DWR Water purchase agreement and the groundwater substitution pricing for 2014 that was actually paid by DWR, the lost water transfer revenue that would have occurred due to lower transfer volumes in 2014 with the commenters recommended changes to YCWA's Condition AR3 would have been about $40 million.

- In 2014, there would have been even greater water supply shortages than those that occurred with the Yuba Accord flow requirements in effect, and the year would have been a Schedule 6 year instead of a Schedule 5 year.

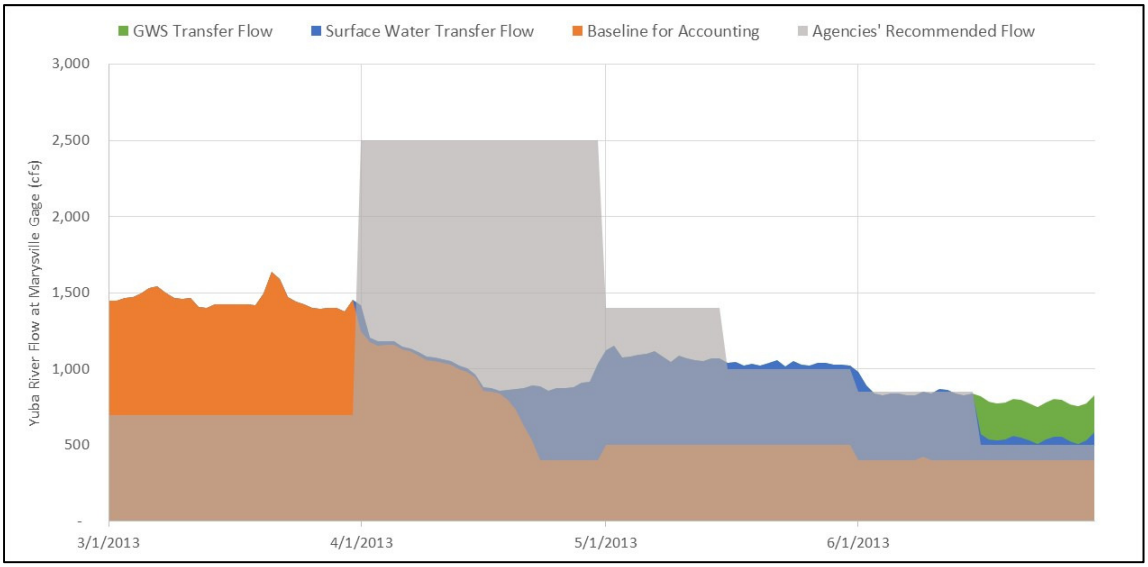

Figure AR3-14. 2013 Yuba Accord water transfer flows with CDFW's recommended flows superimposed in grey.

- The CDFW, FWS FWN recommended changes to YCWA's Condition AR3 would not significantly change the average annual total generation relative to generation under the Base Case, but there would be substantial reductions in total power generation revenues, and large single year impacts to generation revenues. Reduced generation value from the commenter's recommended changes to YCWA's Condition AR3 would occur due to the shifting of generation from higher priced months to lower priced months. The model used to evaluate generation value (AFLA Exhibit D Section 5.2) uses the average of 2015 and 2016 California Independent System Operator (CAISO) power prices, and those prices during March and April are 20 percent lower than the average prices for the rest of the months of the year. The average combined March and April power price used in the modeling is $25.43/MWh, and the average of all other months is $31.43/MWh. The recommended higher flows during late March and April would result in significantly increased powerhouse releases during late March and April in some years relative to the Base Case and reduced generation during other months. The higher recommended flow requirement during late March and April in Schedule 1 years and during April of Schedule 2 years also would reduce the capacity for ancillary services during those times because it would require a high percentage of the capacity of New Colgate Powerhouse to be allocated to releases of water, which would reduce available capacity for flow ramping. Overall, the commenters' recommended changes to YCWA's Condition AR3 would result in nearly a 1% average annual reduction, equal to $375,737, in power generation revenue for the Project relative to the Base Case, which would be a $11.3 million reduction over the term of a 30-year license. The greatest single year revenue decrease for the AR3a simulation

model run (CDFW_FWS_FWN_AR3a) is for 2009, with about a 17% reduction in power revenue, equal to $7 million relative to the Base Case. Estimated changes in annual average power generation and power generation revenues are provided in the Technical Report "Modeling Approach to Support Responses to Flow-Related Recommendations" attached to YCWA's master response document and filed under separate cover.

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