SECTION 8.0

EFFECTS ANALYSIS

8.1 Overview

Under the aggregate effects assessment approach, the Environmental Baseline and the status of the species establish the context for determining the ability of each listed species to withstand additional stressors or the exacerbation of existing stressors that may be caused by the Proposed Action. As the NMFS (1999) policy document states: "[i]*f the species' status is poor and the baseline is degraded at the time of consultation, it is more likely that any additional adverse effects caused by the proposed or continuing action will be significant"*.

The effects analysis in this Applicant-Prepared Draft BA is conducted to assist NMFS in determining whether the Proposed Action will cause "…*some deterioration in the species' pre-action condition*" (*National Wildlife Federation v. NMFS, 524 F.3d 917, 930 (9th Cir. 2008*). As the court stated in that decision, "…*an agency only 'jeopardize[s]' a species if it causes some new jeopardy.*" (*Ibid.*) The effects analysis in this Applicant-Prepared Draft BA also considers the guidance provided by this Ninth Circuit decision that states "…*an agency may not take action that will tip a species from a state of precarious survival into a state of likely extinction. Likewise, even where baseline conditions already jeopardize a species, an agency may not take action that deepens the jeopardy by causing additional harm.*" (*Ibid.*)

8.2 Assessment of Environmental Baseline Conditions

The limiting factors, threats and stressors associated with the Environmental Baseline, which have led to the current status of each of the listed species, are described in detail in Sections 5.0 and 6.0 of this Applicant-Prepared Draft BA. The magnitudes of each of the identified stressors affecting the target species in the lower Yuba River under the Environmental Baseline are evaluated and described in Section 6.0. Provided below are brief summaries regarding the viabilities of the listed species at the ESU or DPS level, followed by brief summaries of the viability status of each species in the Action Area under the Environmental Baseline, to provide context for the aggregate effects analysis.

8.2.1 Central Valley Spring-run Chinook Salmon ESU

For the ESU-wide Environmental Baseline effects assessment of the spring-run Chinook salmon, NMFS (2009b) found that the entire suite of limiting factors, threats and stressors associated with the Environmental Baseline have resulted in an unstable ESU that has moderate risk of extinction. Therefore, spring-run Chinook salmon would not be expected to be able to tolerate additional stressors associated with a proposed new action that would be substantial enough to adversely affect spring-run Chinook salmon at the ESU level.

8.2.2 Lower Yuba River Spring-run Chinook Salmon

This Applicant-Prepared Draft BA has presented available information regarding the status of the VSP parameters of spatial structure, abundance, productivity, and diversity of spring-run Chinook salmon in the lower Yuba River under the Environmental Baseline. Additionally, available information regarding the PBFs and characteristics of critical habitat in the Action Area of the lower Yuba River has been described and discussed, including the relative magnitudes of the stressors affecting the Yuba River spring-run Chinook salmon population. Regarding the VSP parameter of spatial structure, the lower Yuba River is characterized by a complex organization of MUs. Although flow-dependent fry and juvenile rearing habitat availability under the Environmental Baseline represents a low stressor to spring-run Chinook salmon, 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.

In addressing the VSP parameters of abundance and productivity, the entire suite of information and analyses indicates that the phenotypic spring-run Chinook salmon annual abundance in the lower Yuba River over the evaluated time period is stable, and is not exhibiting a significant declining trend. Under the Environmental Baseline, these abundance and trend considerations would correspond to low extinction risk through application of NMFS criteria (Lindley et al. 2007). According to NMFS (2016) status review for spring-run Chinook salmon, recent data based on VAKI Riverwatcher™ counts for the lower Yuba River suggest that the spring-run Chinook salmon population's size meets the low extinction risk criteria for abundance (ranging from a few hundred to a few thousand fish). This conclusion would indicate that phenotypic spring-run Chinook salmon in the lower Yuba River are not in "*a state of precarious survival"* and may have the capacity to tolerate incremental adverse effects without tipping the population "*into a state of likely extinction."*

However, the estimated number of spring-run Chinook salmon passing Daguerre Point Dam during 2015 was the lowest of all 12 years of available VAKI Riverwatcher™ data. Moreover, the RMT (2013a) questions the applicability of any of these criteria addressing extinction risk, because they presumably apply to independent populations and, as previously discussed, lower Yuba River anadromous salmonids represent introgressive hybridization of larger Feather-Yuba river populations, with substantial contributions of hatchery-origin fish to the annual runs. In fact, NMFS (2016) states that the population is likely at high extinction risk due to hatchery influence.

Regarding the VSP parameter of diversity, spring-run Chinook salmon exhibit diverse spatial and temporal distributions in patterns of adult upstream migration, holding and spawning which may infer spreading of extinction risk in a variable environment, such as the lower Yuba River. However, regarding genetic diversity, available information indicates that phenotypic spring-run Chinook salmon in the lower Yuba River actually represents hybridization between spring- and fall-run Chinook salmon in the lower Yuba River, and hybridization with Feather River stocks including the FRFH spring-run Chinook salmon stock, which itself represents a hybridization between Feather River fall- and spring-run Chinook salmon populations.

Overall, consideration of the available data including estimated abundance, trends, and particularly hatchery contribution suggest that the lower Yuba River spring-run Chinook salmon population are at a moderate to high extinction risk. Given the above considerations, it is reasonable to suggest that spring-run Chinook salmon in the lower Yuba River have a limited capacity to tolerate additional incremental adverse effects associated with a specific action.

8.2.3 Central Valley Steelhead DPS

According to NMFS (NMFS 2014), data are lacking to suggest that the Central Valley steelhead DPS is at low risk of extinction, or that there are viable populations of steelhead anywhere in the DPS.

Nonetheless, for the DPS-wide Environmental Baseline effects assessment of steelhead, NMFS (2016a) found that the entire suite of limiting factors, threats and stressors associated with the Environmental Baseline have resulted in an unstable DPS that has high risk of extinction (Williams et al. 2011; Williams et al. 2016). Therefore, steelhead would not be expected to be able to tolerate additional stressors associated with a proposed new action that would be substantial enough to adversely affect steelhead at the DPS level.

8.2.4 Lower Yuba River Steelhead

The previous discussion summarizing the viability of spring-run Chinook salmon, particularly the discussion regarding the VSP parameter of spatial structure, also generally applies to steelhead in the lower Yuba River.

Data limitations preclude the ability to make conclusions regarding abundance and productivity of steelhead in the lower Yuba River. These data limitations include the relatively short time period encompassed by the reporting of reliable abundance estimates, and the consideration that some steelhead may have returned to the river but remained and spawned in the river downstream of Daguerre Point Dam. Additional data limitations include issues surrounding residency versus anadromy of *O. mykiss* in the lower Yuba River. For the lower Yuba River, these data limitations preclude extended multi-year abundance and trend analyses, and therefore also render problematic conclusions regarding the VSP parameters of abundance and productivity.

Regarding the VSP parameter of diversity, *O. mykiss* (including steelhead) in the lower Yuba River exhibit a high amount of diversity in phenotypic expression and life history strategy. *O. mykiss* (including steelhead) exhibit highly diverse spatial and temporal distributions in patterns of spawning, and juvenile outmigration. Moreover, *O. mykiss* in the lower Yuba River exhibit polyphenism, or the occurrence of several phenotypes in a population which may not be due to different genetic types, including expressions of anadromy or residency. However, genetic analysis, the history of planting steelhead in the lower Yuba River, and the historical and ongoing straying of hatchery steelhead into the lower Yuba River suggests that current populations of *O. mykiss* in the lower Yuba River do not represent a pure ancestral genome.

Overall, consideration of the available data, estimated abundance, trends and hatchery contribution indicate that the lower Yuba River steelhead population is at a high extinction risk. Given the above considerations, it is reasonable to suggest that steelhead in the lower Yuba River have limited capacity to tolerate additional incremental adverse effects associated with a specific action.

8.2.5 Southern DPS of North American Green Sturgeon

According to NMFS (2009b), the population status of the Southern DPS of North American green sturgeon at that time was unknown. However, more recent studies (Israel et al. 2009) provide more reliable indices (e.g., minimum effective spawner population size), and Sacramento River DIDSON counts provide annual total spawner estimates (NMFS 2015b). The total number of adults in the Southern DPS population is estimated to be about 1,348 (E. Mora, pers. comm. UC Davis, May 6, 2015, as cited in NMFS 2015a). For the Central Valley Domain, currently there are limited data on population sizes, population trends, or productivity of green sturgeon (NMFS 2015a). Nonetheless, NMFS (2016b) concluded that the risk of extinction for the Southern DPS of green sturgeon under the Environmental Baseline is moderate because, although threats due to habitat alteration are thought to be high and indirect evidence suggests a decline in abundance, there is much uncertainty regarding the scope of threats and the viability of population abundance indices. Therefore, it is reasonable to assume that green sturgeon would not be expected to be able to tolerate additional stressors associated with a proposed new action that would be substantial enough to adversely affect green sturgeon at the DPS level.

8.2.6 Lower Yuba River Green Sturgeon

No information regarding the VSP parameters of abundance, productivity and diversity (phenotypic or genetic) is available for the lower Yuba River, due to the rarity of sighting green sturgeon in the river. Hence, it is not practicable to attempt to apply the VSP concepts developed for salmonids to green sturgeon in the lower Yuba River. Moreover, because of the lack of information pertaining to abundance, productivity, habitat utilization, life history and behavioral patterns in the lower Yuba River, due to infrequent sightings over the past several decades, it is not possible to apply reliable alternative methods of viability assessment of green sturgeon in the lower Yuba River. Data limitations preclude application of the extinction risk criteria to green sturgeon in the lower Yuba River, and draw into question whether an attempt to do so is even warranted. In fact, according to NMFS (2016b) "… *current scientific information indicates that sDPS green sturgeon is composed of a single, independent population, which principally spawns in the mainstem Sacramento River, and also breeds opportunistically in the Feather River and possibly even the Yuba River.*" Consequently, the discussions in the following sections regarding the effects of the Proposed Action on green sturgeon are restricted to an evaluation of whether or not potential habitat changes in the lower Yuba River downstream of Daguerre Point Dam due to the Proposed Action would have the potential to adversely affect green sturgeon critical habitat.

8.3 Effects of the Proposed Action

8.3.1 Direct and Indirect Effects

For each stressor to listed species that was identified under the Environmental Baseline, the following sections determine whether the Proposed Action will affect that stressor, whether that effect will be beneficial or adverse, and the resultant magnitude of effect of each stressor. For this Applicant-Prepared Draft BA, it is recognized that assessing the incremental effect of an individual stressor that could potentiallybe caused by the Proposed Action, and assessing the ability of the listed species to tolerate the incremental effect, are problematic due to the interconnectivity of individual stressors and the inherent variations in biological responses to suites of stressors. Nonetheless, to the extent possible, the net effects analysis addresses the magnitudes of the incremental effects of individual stressors that could potentially be caused by the Proposed Action, and evaluates whether such incremental effects are likely to increase risks to the listed species.

As described in Section 3.0, the Proposed Action is comprised of various structural and operational components. Only some of these components have the potential to result in changes that could affect stressors to listed fish species and their critical habitats in the lower Yuba River. As part of the process to deconstruct the Proposed Action into its constituent parts, environmental stressors that will be directly or indirectly caused by, or that will have the potential to be changed by, operations-related components of the Proposed Action were identified, and the components of the Proposed Action that could result in flow- and water temperature-related changes associated with the Proposed Action were identified. As part of this effects assessment, the pathway or pathways of exposure (e.g., flow-dependent habitat availability) and the intensities of those flow- and water temperature-related stressors also were considered with respect to the spatial and temporal distribution of those stressors, species-specific potential for exposure, and species-specific response to exposure within the Action Area (i.e., lower Yuba River). Rather than performing an analysis of potential effects associated with each individual proposed operational change, the effects assessment relied upon hydrological modeling to simulate operations of the Proposed Action as a whole, to assess potential downstream flow and water temperature effects of the Proposed Action on listed species and critical habitat in the lower Yuba River.

8.3.1.1 Spring-run Chinook Salmon

Flow-dependent analyses in this Applicant-Prepared Draft BA used modeled flows and water temperatures to quantify spawning habitat availability, potential redd dewatering, fry and juvenile rearing habitat availability, potential juvenile isolation, and lifestage-specific water temperature suitabilities for spring-run Chinook salmon. Methods to conduct the flow-dependent analyses are described in Section 6.0. Each of these considerations are evaluated in this Section 8.0 under the Proposed Action scenario relative to the Environmental Baseline, and their relative magnitudes as stressors to spring-run Chinook salmon in the lower Yuba River are presented.

8.3.1.1.1 Flow-Dependent Habitat Conditions

Spawning Habitat Availability

Spawning WUA for spring-run Chinook salmon was evaluated for simulated flows up to 5,000 cfs, which generally represents the bankfull flow in the lower Yuba River. Because flows do not exceed 5,000 cfs over the 41-year simulation period during the September through mid-October spring-run Chinook salmon spawning period, no simulated daily flows were excluded from the spring-run Chinook salmon spawning WUA analysis. Table 8.3-1 displays the long-term average and average by water year type (WYT) spring-run Chinook salmon spawning habitat (percent of maximum WUA) under the Proposed Action and Environmental Baseline.

Table 8.3-1. Long-term and water year type average spring-run Chinook salmon spawning WUA (percent of maximum) under the Proposed Action and Environmental Baseline.

Scenario	Long-term Full Simulation Period[2]	WYTs[1]				
		Wet	Above Normal	Below Normal	Dry	Critical
Proposed Action	99.3	99.3	99.3	99.6	99.6	98.9
Environmental Baseline	98.8	99.3	99.4	99.6	99.6	96.1
Difference	0.5	0.0	-0.1	0.0	0.0	2.8

[1] As defined by the Yuba River Index (YRI) WY Hydrologic Classification.
[2] Based on the WY 1970-2010 simulation period.

Over the entire 41-year simulation period, long-term average spring-run Chinook salmon spawning habitat availability (percent of maximum WUA) in the lower Yuba River is similar under the Proposed Action relative to the Environmental Baseline (long-term average of 99.3 percent versus 98.8 percent of the maximum WUA, respectively). The Proposed Action provides very similar amounts of spawning habitat during wet, above normal, below normal and dry WYs, and provides 2.8 percent more habitat during critical WYs. As with the Environmental Baseline, the Proposed Action provides, on the average, over 80 percent (and even 95 percent) or more of maximum spawning WUA during all WYTs.

Habitat duration for spring-run Chinook salmon spawning under the Proposed Action and Environmental Baseline scenarios are presented in Figure 8.3-1.

The Proposed Action scenario provides similar amounts of spawning habitat availability overall, but provides more spawning habitat availability over about the lowest about 2 percent of the exceedance probability distribution, relative to the Environmental Baseline scenario. The Proposed Action provides 80 percent (and even 90 percent) or more of maximum spawning WUA 100 percent of the time, while the Environmental Baseline scenario provides 80 percent (and even 90 percent) or more of maximum WUA about 98 percent of the time.

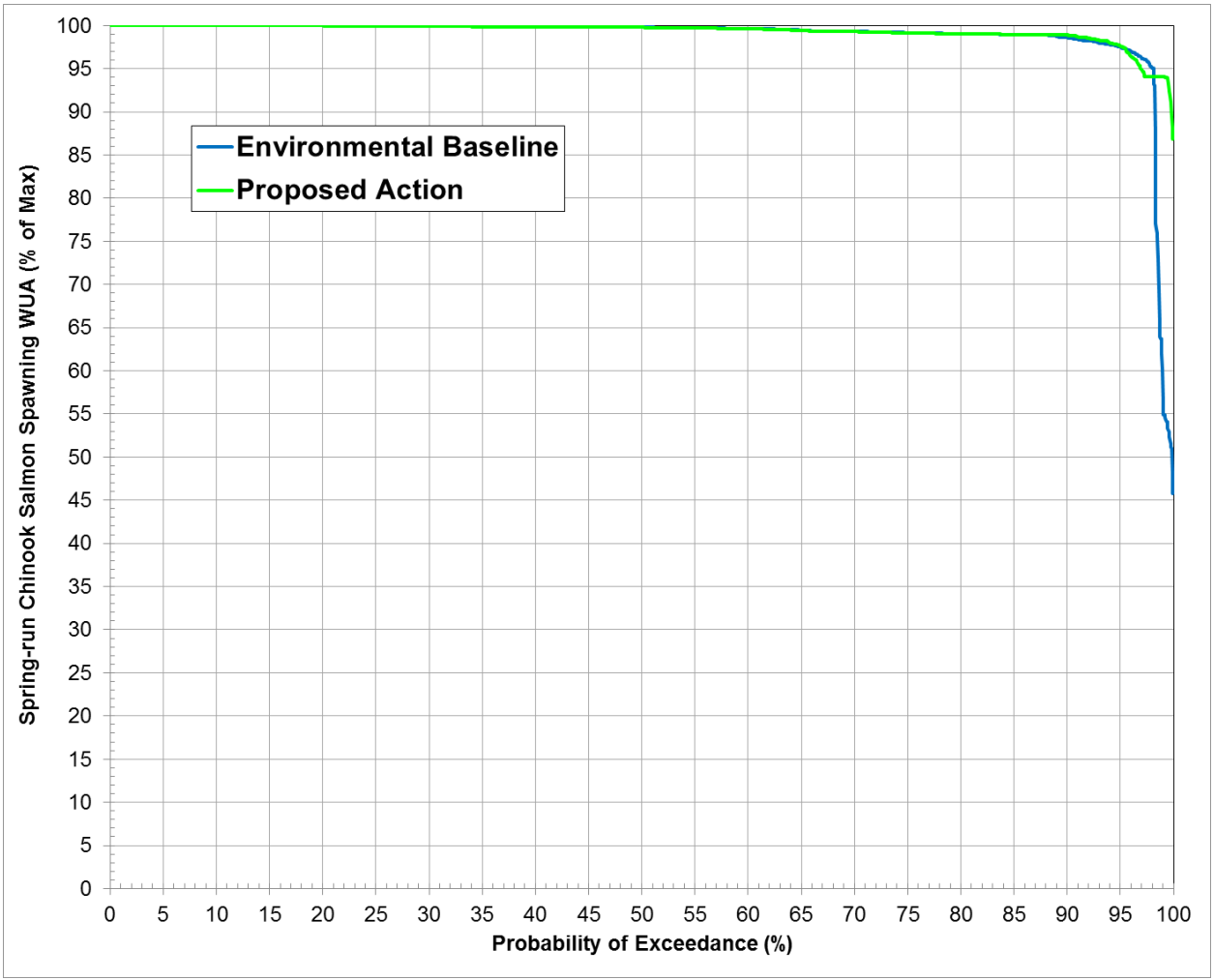

Figure 8.3-1. Spring-run Chinook salmon spawning habitat duration over the 41-year hydrologic period for the Proposed Action and Environmental Baseline scenarios.

During the one conference year (WY 1977) in the simulated period of evaluation (WY 1970-2010), for analytical purposes the corresponding spring-run Chinook salmon spawning period extends from September 1 – October 15 of 1977. During that spawning season, 94 percent of spring-run Chinook salmon maximum spawning WUA was provided under the Proposed Action, compared to 72 percent provided under the Environmental Baseline.

Spring-run Chinook salmon spawning habitat availability under the Proposed Action is generally similar to the Environmental Baseline overall, provides more habitat during the conference WY, and represents a low stressor under the Proposed Action.

Potential Redd Dewatering

Since the development of the existing flow fluctuation criteria, additional data and information have been collected and models have been developed to better analyze the potential for spring-run Chinook salmon redd dewatering in the Yuba River (see Section 6.0 of this Applicant-

Prepared Draft BA). Proposed new flow fluctuation criteria were developed for the Proposed Action (see Proposed Condition AR9, *Control Project Ramping and Flow Fluctuation Downstream of Englebright Dam* in Appendix E2 of the Amended FLA).

For every day of the annual embryo incubation period over 41 years, the long-term annual averages of the percentages of spring-run Chinook salmon redds potentially dewatered under the Proposed Action and Environmental Baseline scenarios both are very low, only 0.02 percent and 0.01 percent, respectively. Applying the 41-year average of estimated redd dewatering, it is estimated that essentially no spring-run Chinook salmon redd would be expected to have been dewatered under either the Proposed Action or the Environmental Baseline scenario during 2009 and 2010[1].

The average percentage of redds potentially dewatered would be very small, and would be very similar under the Proposed Action, relative to the Environmental Baseline during all WYTs (Table 8.3-2).

Table 8.3-2. Estimated spring-run Chinook salmon redd and egg pocket potential dewatering under the Proposed Action relative to the Environmental Baseline.

WYT Categories	Redd Dewatering Index (%)			Egg Pocket Dewatering Index (%)		
	Proposed Action	Environmental Baseline	Difference	Proposed Action	Environmental Baseline	Difference
Long-term (All WYs)	0.02%	0.01%	0.01%	0.00%	0.00%	0.00%
Wet	0.03%	0.02%	0.01%	0.00%	0.00%	0.00%
Above Normal	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%
Below Normal	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Dry	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Critical	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

[1] As defined by the Yuba River Index (YRI) WY Hydrologic Classification.
[2] Based on the WY 1970-2010 simulation period.

The long-term and WYT averages of the percentage of egg pockets dewatered indicate that no egg pockets would be dewatered under the Proposed Action scenario or the Environmental Baseline scenario during any WYT. During the one conference year (WY 1977) in the simulated period of evaluation (WY 1970-2010), no redds or egg pockets would potentially be expected to be dewatered under the Proposed Action scenario or under the Environmental Baseline scenario.

Proposed Condition AR9, Control Project Ramping and Flow Fluctuation Downstream of Englebright Dam, was developed in part to minimize the potential for spring-run Chinook salmon redd dewatering during the period from September 2 through December 31 (corresponding to the spring-run Chinook salmon spawning and incubation period). Under this proposed condition, Licensee shall not reduce the flow downstream of Englebright Dam to less

[1] All phenotypic spring-run Chinook salmon redds identified in the lower Yuba River during the weekly near-census 2009 and 2010 Chinook salmon redd surveys were combined into one dataset. As described in Section 6.0, an estimated 1,148 and 1,465 spring-run Chinook salmon redds were constructed in the lower Yuba River during 2009 and 2010, respectively. See Section 6.5 for the detailed description of the redd dewatering methodology.

than the larger of: 1) the applicable minimum streamflow requirement specified in YCWA's Proposed Condition AR3; or 2) the flow that would result from applying the maximum flow reduction amount specified in Table 1 of this condition corresponding to the base flow range determined using the maximum 5-day average flow that occurred on days when this condition was in effect during that September 2 through December 31 period. During the period of September 2 through 5, the base flow range for this proposed condition shall be determined by the average daily flow on September 1.

Proposed Condition AR9 would not necessarily apply to every day each year of the embryo incubation period. It would not apply: (a) to Project operations during emergencies, (b) to releases required by USACE's flood control criteria, (c) to releases required to maintain a flood control buffer or for other flood control purposes, (d) to bypasses of uncontrolled flows into Englebright Reservoir, (e) during times when Englebright Dam is spilling, or (f) when releases are governed by the limits of Table 3 of this condition. When this condition would apply, Licensee shall make reasonable efforts to operate New Bullards Bar Reservoir and Project facilities downstream of Englebright Dam and coordinate with the operator of the Narrows Project (FERC Project No. 1403) to avoid fluctuations in the flow of the Yuba River downstream of Englebright Dam and daily changes in Project operations affecting releases or bypasses of flow downstream of Englebright Dam shall be continuously measured at USGS Smartsville Streamflow Gage 11418000.

During the days over the 41-year period of evaluation when this proposed condition would apply, it would provide the intended protection for spring-run Chinook salmon redd dewatering (Table 8.3-3).

Table 8.3-3. Estimated spring-run Chinook salmon redd and egg pocket potential dewatering under the Proposed Action relative to the Environmental Baseline for those days in the 41-year period of record during which the flow reduction criteria specified in Proposed Condition AR9 would apply.

WYT Categories	Redd Dewatering Index (%)			Egg Pocket Dewatering Index (%)		
	Proposed Action	Environmental Baseline	Difference	Proposed Action	Environmental Baseline	Difference
Long-term (All WYs)	0.02%	0.01%	0.01%	0.00%	0.00%	0.00%
Wet	0.03%	0.02%	0.01%	0.00%	0.00%	0.00%
Above Normal	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%
Below Normal	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Dry	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Critical	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Spring-run Chinook salmon redd dewatering under the Proposed Action scenario is estimated to be very low and similar to that under the Environmental Baseline. Redd dewatering under the Proposed Action represents a low stressor to spring-run Chinook salmon.

Fry and Juvenile Rearing Habitat Availability

Spring-run Chinook Salmon Fry Rearing In-Channel Habitat

Table 8.3-4 displays the long-term average and average by WYT spring-run Chinook salmon fry rearing in-channel habitat (percent of maximum WUA) under the Proposed Action and Environmental Baseline scenarios.

Table 8.3-4. Long-term and WYT average spring-run Chinook salmon fry in-channel rearing WUA (percent of maximum) under the Proposed Action and Environmental Baseline scenarios.

Scenario	Long-term Full Simulation Period[2]	WYTs[1]				
		Wet	Above Normal	Below Normal	Dry	Critical
Proposed Action	88.6	88.6	89.0	87.6	88.0	89.7
Environmental Baseline	88.6	88.6	88.9	87.6	88.2	89.7
Difference	0.0	0.0	0.1	0.0	-0.2	0.0

[1] As defined by the Yuba River Index (YRI) WY Hydrologic Classification.
[2] Based on the WY 1970-2010 simulation period.

During the mid-November through mid-February spring-run Chinook salmon fry rearing period, flows exceed 5,000 cfs during about 13 percent of the days over the 41-year simulation period for the Proposed Action, and during about 12 percent of the days under the Environmental Baseline. These days were excluded from the spring-run Chinook salmon fry in-channel rearing WUA analysis.

Over the entire 41-year simulation period, long-term average fry rearing in-channel habitat availability (percent of maximum WUA) in the lower Yuba River is the same under the Proposed Action and Environmental Baseline scenarios (long-term average of 88.6 percent of the maximum WUA). The Proposed Action and Environmental Baseline scenarios result in very similar amounts of WUA by WYT. Both the Proposed Action and Environmental Baseline scenario provide an average of over 80 percent of fry rearing maximum WUA during all WYTs.

Habitat durations for spring-run Chinook salmon fry rearing under the Proposed Action and Environmental Baseline scenarios are presented in Figure 8.3-2. The Proposed Action and Environmental Baseline scenarios provide very similar amounts of habitat over the entire distribution. Both the Proposed Action and Environmental Baseline scenarios provide over 80 percent fry rearing maximum WUA over the entire exceedance distributions.

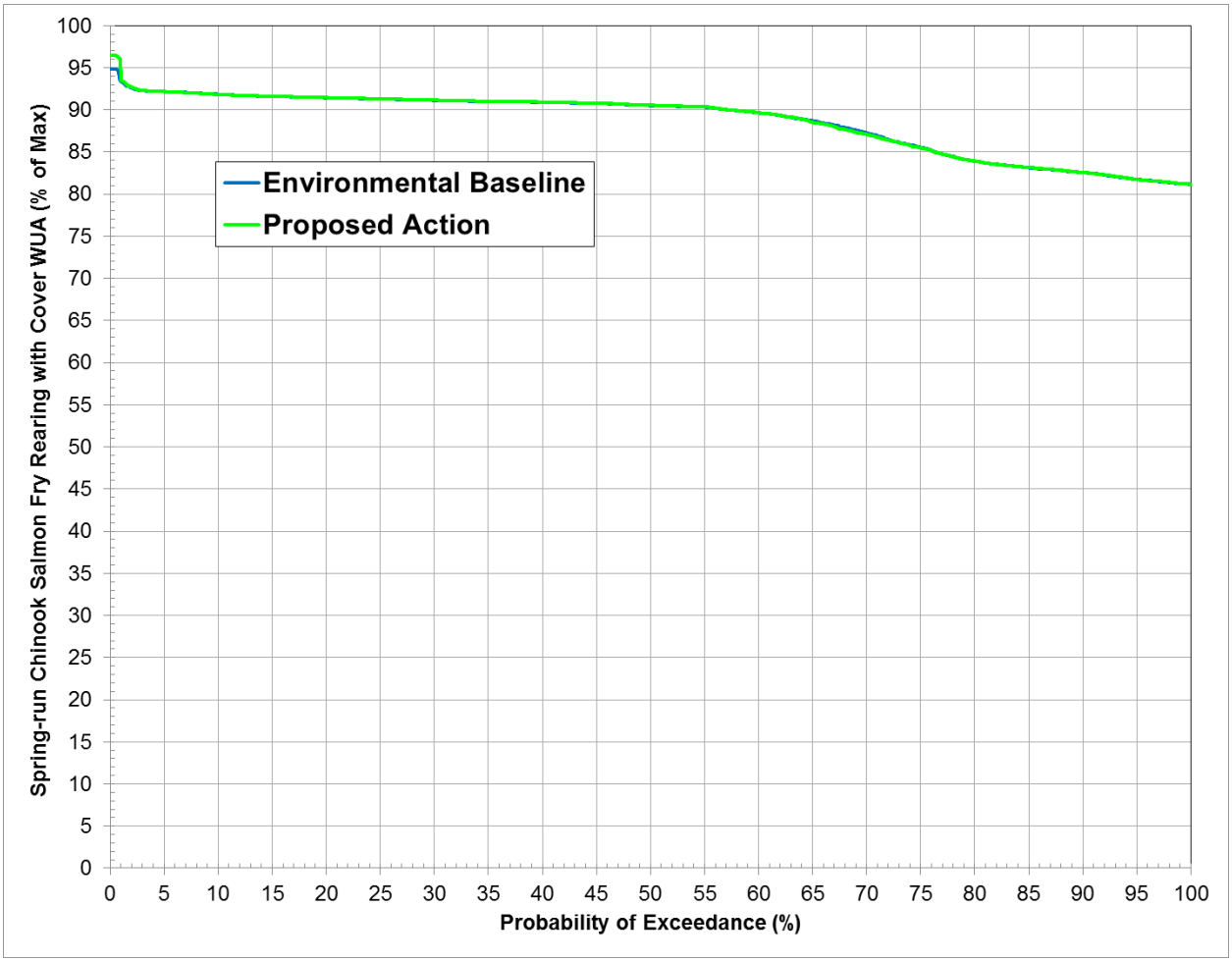

Figure 8.3-2. Spring-run Chinook salmon fry in-channel rearing habitat duration over the 41-year hydrologic period for the Proposed Action and Environmental Baseline scenarios.

During the fry rearing season of the one conference year (WY 1977) in the simulated period of evaluation (WY 1970-2010), 91.2 percent of spring-run Chinook salmon fry rearing maximum WUA was provided under both the Proposed Action scenario and the Environmental Baseline scenario.

Spring-run Chinook Salmon Fry Rearing Full-Flow Habitat

Table 8.3-5 displays the full-flow analysis of the amounts (ac) of spring-run Chinook salmon fry WUA without cover under the Proposed Action and the Environmental Baseline over the 41-year period of evaluation. Results are shown for all days, for days when flows were less than or equal to 5,000 cfs and for days when flows were greater than 5,000 cfs, and the differences between the two scenarios over the long-term full simulation period (all years) and by WYT.

For the entire simulation period, very similar amounts of fry rearing habitat (average WUA) are available under the Proposed Action compared to the Environmental Baseline as well as for each of the WYTs.

Table 8.3-5. Long-term average WUA (ac) over the 41-year period of evaluation and WYT-specific relative contribution to the long-term average WUA of spring-run Chinook salmon fry rearing habitat, under the Proposed Action and the Environmental Baseline.

Scenario	Long-term Full Simulation Period[2]	WYTs[1]				
		Wet	Above Normal	Below Normal	Dry	Critical
Proposed Action						
Total Days in Analysis	**3,772**	**1,380**	**552**	**644**	**460**	**736**
Days ≤ 5,000 cfs	3,298	959	507	639	458	735
Days > 5,000 cfs	474	421	45	5	2	1
Avg. WUA	**154.4**	**58.1**	**22.4**	**25.3**	**18.3**	**30.3**
WUA ≤ 5,000 cfs	131.1	37.4	20.2	25.1	18.2	30.2
WUA > 5,000 cfs	23.3	20.7	2.2	0.2	0.1	0.0
Environmental Baseline						
Total Days in Analysis	**3,772**	**1,380**	**552**	**644**	**460**	**736**
Days ≤ 5,000 cfs	3,317	979	506	639	458	735
Days > 5,000 cfs	455	401	46	5	2	1
Avg. WUA	**154.3**	**58.0**	**22.3**	**25.3**	**18.3**	**30.3**
WUA ≤ 5,000 cfs	131.8	38.1	20.1	25.1	18.2	30.2
WUA > 5,000 cfs	22.5	19.9	2.3	0.2	0.1	0.0
Differences						
Avg. WUA	**0.1**	**0.1**	**0.1**	**0.0**	**-0.1**	**0.0**
% change	**0.1%**	**0.2%**	**0.3%**	**0.0%**	**-0.4%**	**0.0%**

[1] As defined by the Yuba River Index (YRI) WY Hydrologic Classification.
[2] Based on the WY 1970-2010 simulation period.

Figure 8.3-3 displays the full-flow analysis of the average amounts (ac) of spring-run Chinook salmon fry WUA without cover under the Proposed Action and the Environmental Baseline. For both scenarios, the highest average spring-run Chinook salmon fry habitat (WUA) occurred during wet WYs, followed by critical WYs and with lesser amounts during above normal, below normal, and dry WYTs. For both the Proposed Action and Environmental Baseline scenarios, relatively little or no additional fry rearing habitat is provided by days when flows were > 5,000 cfs for below normal, dry, and critical WYTs.

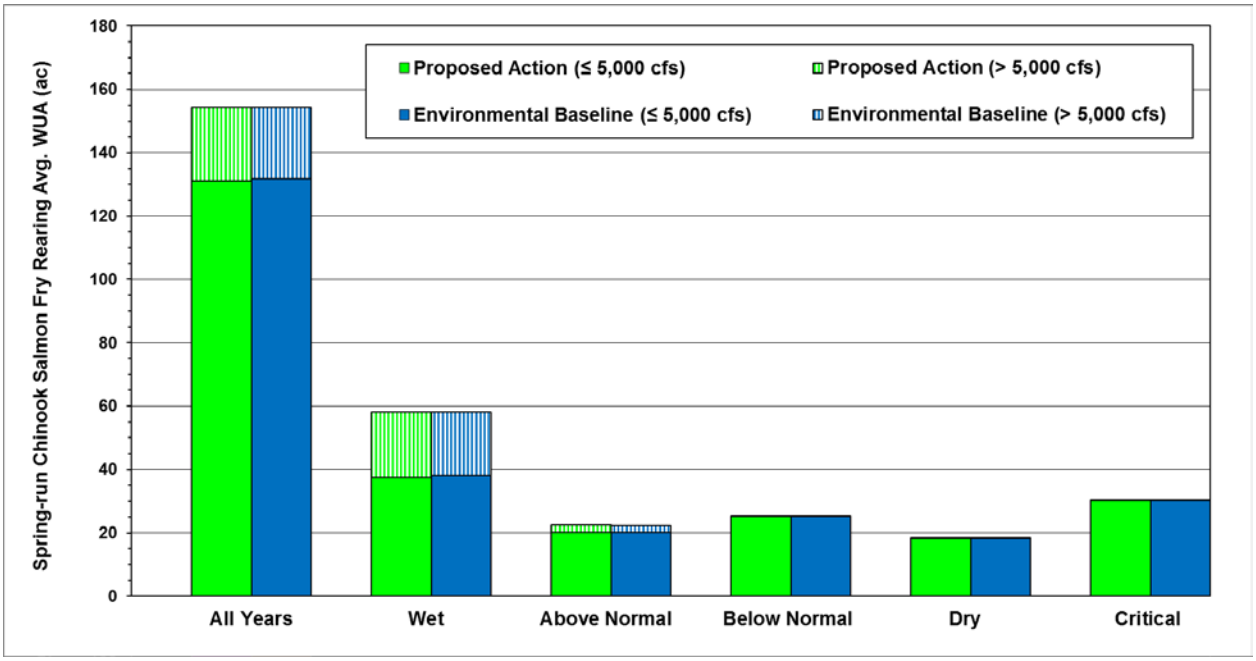

Figure 8.3-3. Comparison of the average amount (ac) of spring-run Chinook salmon fry weighted usable area (WUA) without cover under the Proposed Action and the Environmental Baseline over the 41-year period of evaluation. Shown are the average amounts over the long-term full simulation period (all years) and by water year type of habitat provided on days when flows were ≤ 5,000 cfs and for days when flows were > 5,000 cfs.

Spring-run Chinook Salmon Juvenile Rearing In-Channel Habitat

Table 8.3-6 displays the long-term average and average by WYT spring-run Chinook salmon juvenile rearing in-channel habitat (percent of maximum WUA) under the Proposed Action and Environmental Baseline scenarios.

During the year-round spring-run Chinook salmon juvenile rearing period, flows exceed 5,000 cfs during about 11 percent of the days over the 41-year simulation period for the Proposed Action, and about 10 percent of the days under the Environmental Baseline scenarios. These days were excluded from the spring-run Chinook salmon juvenile in-channel rearing WUA analysis.

Over the entire 41-year simulation period, long-term average juvenile in-channel rearing habitat availability in the lower Yuba River is similar under the Proposed Action and Environmental Baseline scenarios (long-term average of 96.5 percent and 96.3 percent of maximum WUA, respectively). The Proposed Action and Environmental Baseline scenarios also result in very similar amounts of WUA by WYT, although the Proposed Action provides slightly more habitat (0.7 percent) during critical WYs. Both the Proposed Action and Environmental Baseline scenarios provide over 80 percent (and even 95 percent) of juvenile in-channel rearing maximum WUA during all WYTs.

Table 8.3-6. Long-term and WYT average spring-run Chinook salmon juvenile rearing WUA (percent of maximum) under the Proposed Action and Environmental Baseline scenarios.

Scenario	Long-term Full Simulation Period[2]	WYTs[1]				
		Wet	Above Normal	Below Normal	Dry	Critical
Proposed Action	96.5	95.6	95.7	96.4	97.5	97.8
Environmental Baseline	96.3	95.5	95.7	96.4	97.5	97.1
Difference	0.2	0.1	0.0	0.0	0.0	0.7

[1] As defined by the Yuba River Index (YRI) WY Hydrologic Classification.
[2] Based on the WY 1970-2010 simulation period.

Habitat duration for spring-run Chinook salmon juvenile in-channel rearing under the Proposed Action and Environmental Baseline scenarios is presented in Figure 8.3-4. The Proposed Action and Environmental Baseline scenarios provide very similar amounts of habitat over nearly the entire distribution. Both the Proposed Action and Environmental Baseline scenarios achieve over 80 percent (and even 90 percent) of juvenile in-channel rearing maximum WUA with about a 99 percent probability.

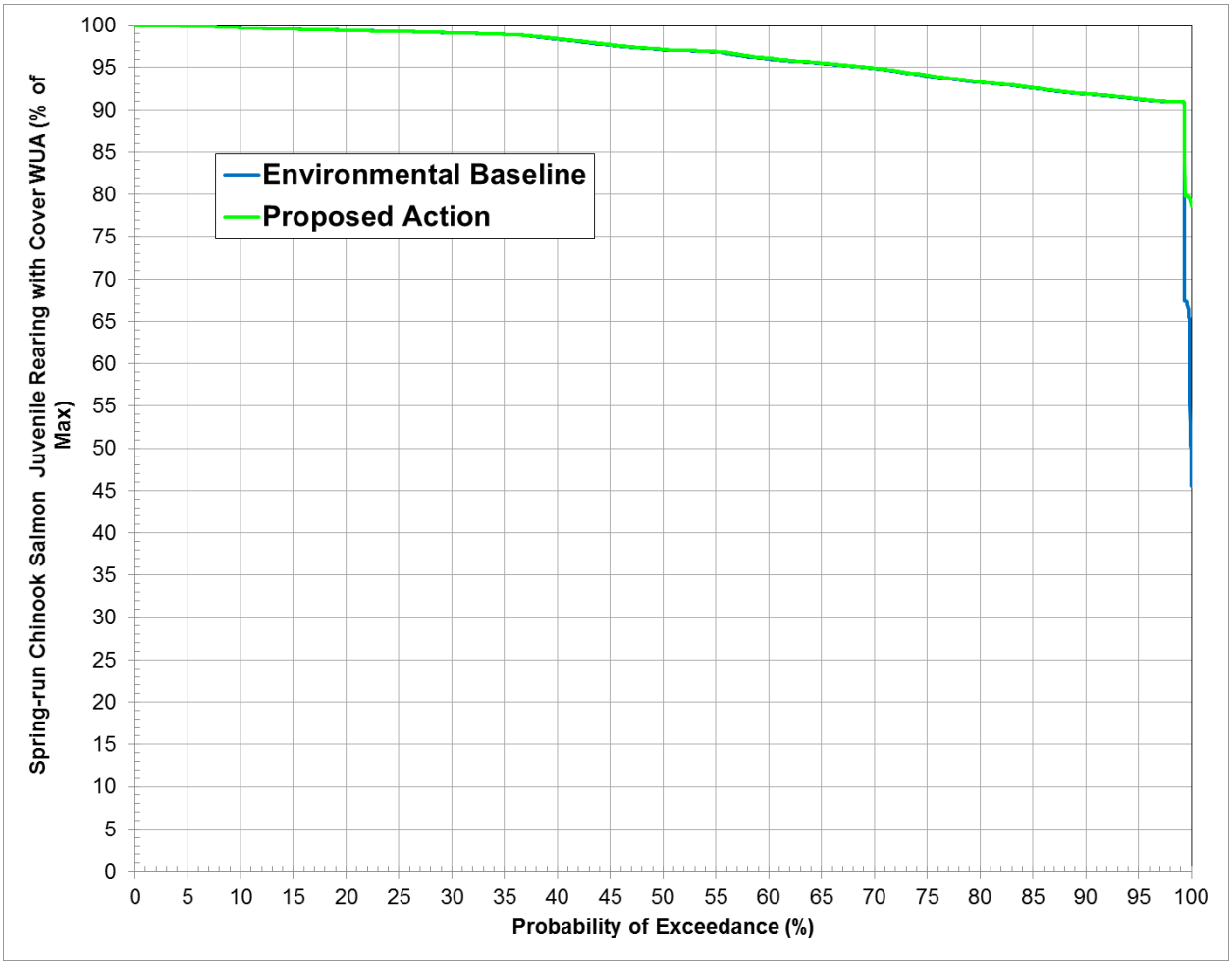

Figure 8.3-4. Spring-run Chinook salmon juvenile in-channel rearing habitat duration over the 41-year hydrologic period for the Proposed Action and Environmental Baseline scenarios.

During the juvenile rearing season of the one conference year (WY 1977) in the simulated period of evaluation (WY 1970-2010), 93.9 percent of spring-run Chinook salmon maximum juvenile in-channel rearing WUA was provided under the Proposed Action compared to 89.0 percent under the Environmental Baseline scenario.

Spring-run Chinook Salmon Juvenile Rearing Full-Flow Habitat

Table 8.3-7 displays the full-flow analysis of the average amounts (ac) of spring-run Chinook salmon juvenile WUA without cover under the Proposed Action and the Environmental Baseline over the 41-year period of evaluation. For the entire simulation period, very similar amounts of juvenile rearing habitat (average WUA) are available under the Proposed Action and the Environmental Baseline. Relative to the Environmental Baseline, the Proposed Action results in very similar amounts of juvenile rearing habitat for all WYTs, with the exception of critical WYs when 0.8 percent more habitat is provided under the Proposed Action.

Table 8.3-7. Long-term average WUA (ac) over the 41-year period of evaluation and WYT-specific relative contribution to the long-term average WUA of spring-run Chinook salmon juvenile rearing habitat, under the Proposed Action and the Environmental Baseline.

Scenario	Long-term Full Simulation Period[2]	WYTs[1]				
		Wet	Above Normal	Below Normal	Dry	Critical
Proposed Action						
Total Days in Analysis	**14,974**	**5,477**	**2,191**	**2,557**	**1,826**	**2,923**
Days ≤ 5,000 cfs	13,387	4,175	2,002	2,468	1,823	2,919
Days > 5,000 cfs	1,587	1,302	189	89	3	4
Avg. WUA	**253.8**	**92.5**	**35.9**	**42.7**	**31.4**	**51.3**
WUA ≤ 5,000 cfs	223.8	67.5	32.6	41.1	31.4	51.3
WUA > 5,000 cfs	30.0	25.0	3.3	1.5	0.0	0.1
Environmental Baseline						
Total Days in Analysis	**14,974**	**5,477**	**2,191**	**2,557**	**1,826**	**2,923**
Days ≤ 5,000 cfs	13,411	4,198	2,003	2,468	1,823	2,919
Days > 5,000 cfs	1,563	1,279	188	89	3	4
Avg. WUA	**253.3**	**92.4**	**35.9**	**42.6**	**31.4**	**50.9**
WUA ≤ 5,000 cfs	223.7	67.8	32.6	41.1	31.4	50.8
WUA > 5,000 cfs	29.6	24.6	3.3	1.5	0.0	0.1
Differences						
Avg. WUA	**0.5**	**0.1**	**0.0**	**0.0**	**0.0**	**0.4**
% change	**0.2%**	**0.1%**	**0.0%**	**0.0%**	**-0.1%**	**0.8%**

[1] As defined by the Yuba River Index (YRI) WY Hydrologic Classification.
[2] Based on the WY 1970-2010 simulation period.

Figure 8.3-5 displays the full-flow analysis of the average amounts (ac) of spring-run Chinook salmon juvenile WUA without cover under the Proposed Action and the Environmental Baseline scenarios. For both scenarios, the highest average spring-run Chinook salmon fry habitat occurred during wet WYs, followed by critical WYs and with lesser amounts during above normal, below normal, and dry WYTs. For both the Proposed Action and Environmental Baseline, relatively little to no additional juvenile rearing habitat is provided by days when flows were > 5,000 cfs for below normal, dry and critical WYTs.

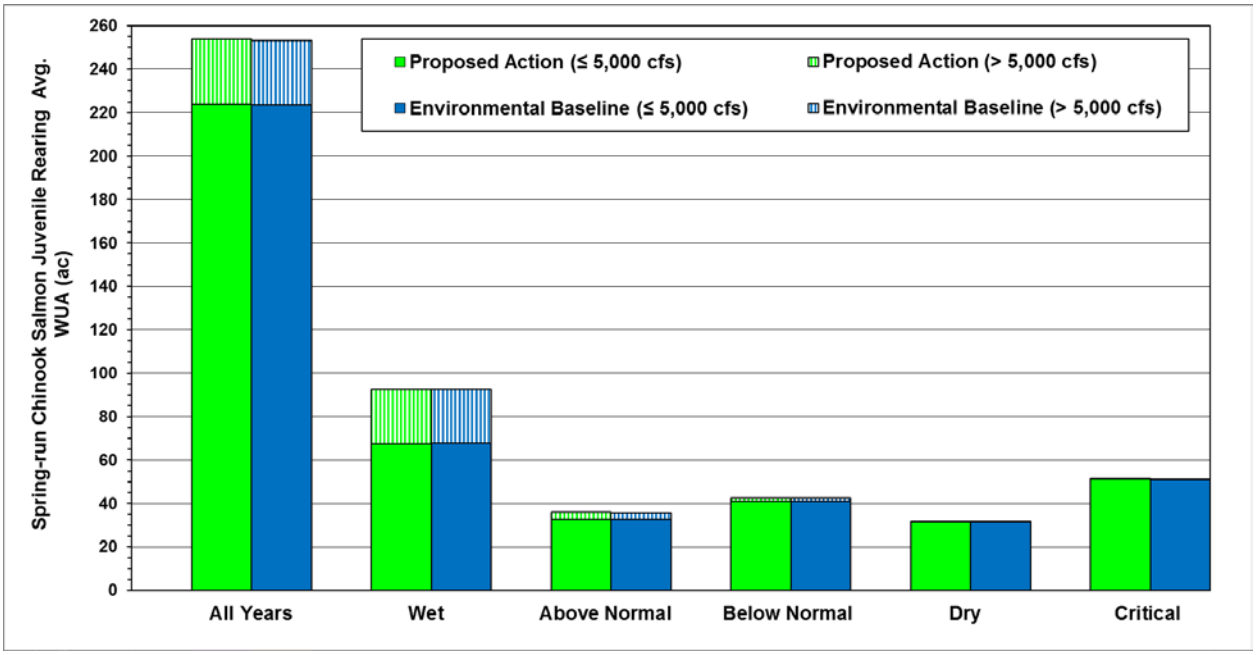

Figure 8.3-5. Comparison of the average amount (ac) of spring-run Chinook salmon juvenile weighted usable area (WUA) without cover under the Proposed Action and the Environmental Baseline over the 41-year period of evaluation. Shown are the amounts over the long-term full simulation period (all years) and by water year type of habitat provided on days when flows were ≤ 5,000 cfs and for days when flows were > 5,000 cfs.

Fry and Juvenile Rearing Habitat as Stressors

Spring-run Chinook salmon flow-dependent fry and juvenile rearing habitat availability under the Proposed Action is very similar to that under the Environmental Baseline. Flow-dependent fry and juvenile rearing habitat (WUA) availability under the Proposed Action represents a low stressor to spring-run Chinook salmon.

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. Fry and juvenile rearing physical habitat structure limitations will remain a high stressor to spring-run Chinook salmon under the various scenarios evaluated in this Applicant-Prepared Draft BA, including the Proposed Action.

Fry and Juvenile Stranding and Isolation

Fry Stranding

Lower Yuba River flows during the winter and spring are often uncontrolled, and stranding of spring-run Chinook salmon fry and juveniles can occur naturally during periods of uncontrolled runoff and spills, either through uncontrolled flow fluctuations or as runoff subsides and flows drop to controllable levels. In addition to existing flow fluctuation and ramping rate restrictions, it is expected that under the Proposed Action, the potential for fry and juvenile stranding will be further minimized associated with implementation of Proposed Condition AR9, *Control Project Ramping and Flow Fluctuations Downstream of Englebright Dam*.

The proposed decrease in ramping rate, from 500 cfs per hour under RD-1644 and article 33(c) of YCWA's existing FERC license, to 200 cfs per hour under the Proposed Action, is anticipated to minimize potential effects to juvenile salmonids associated with stranding in the lower Yuba River.

Juvenile Isolation

The proposed lower maximum authorized ramping rate under the Proposed Action also is anticipated to reduce the potential for juvenile isolation in the lower Yuba River, relative to the Environmental Baseline. The lower maximum authorized ramping rate may better allow juvenile salmonids to volitionally move out of off-channel areas.

Figure 8.3-6 displays the annual average number of off-channel areas (as a percentage of the total number of off-channel areas) that experience *n* isolation events in the entire lower Yuba River for the Proposed Action and Environmental Baseline scenarios separately for all water years combined, and for wet, above normal, below normal, dry and critical WYs. The relative frequencies of isolation events under the Proposed Action and Environmental Baseline scenarios are very similar. The frequency of isolation events generally decreases from wetter to drier WYTs under both the Proposed Action and Environmental Baseline scenarios.

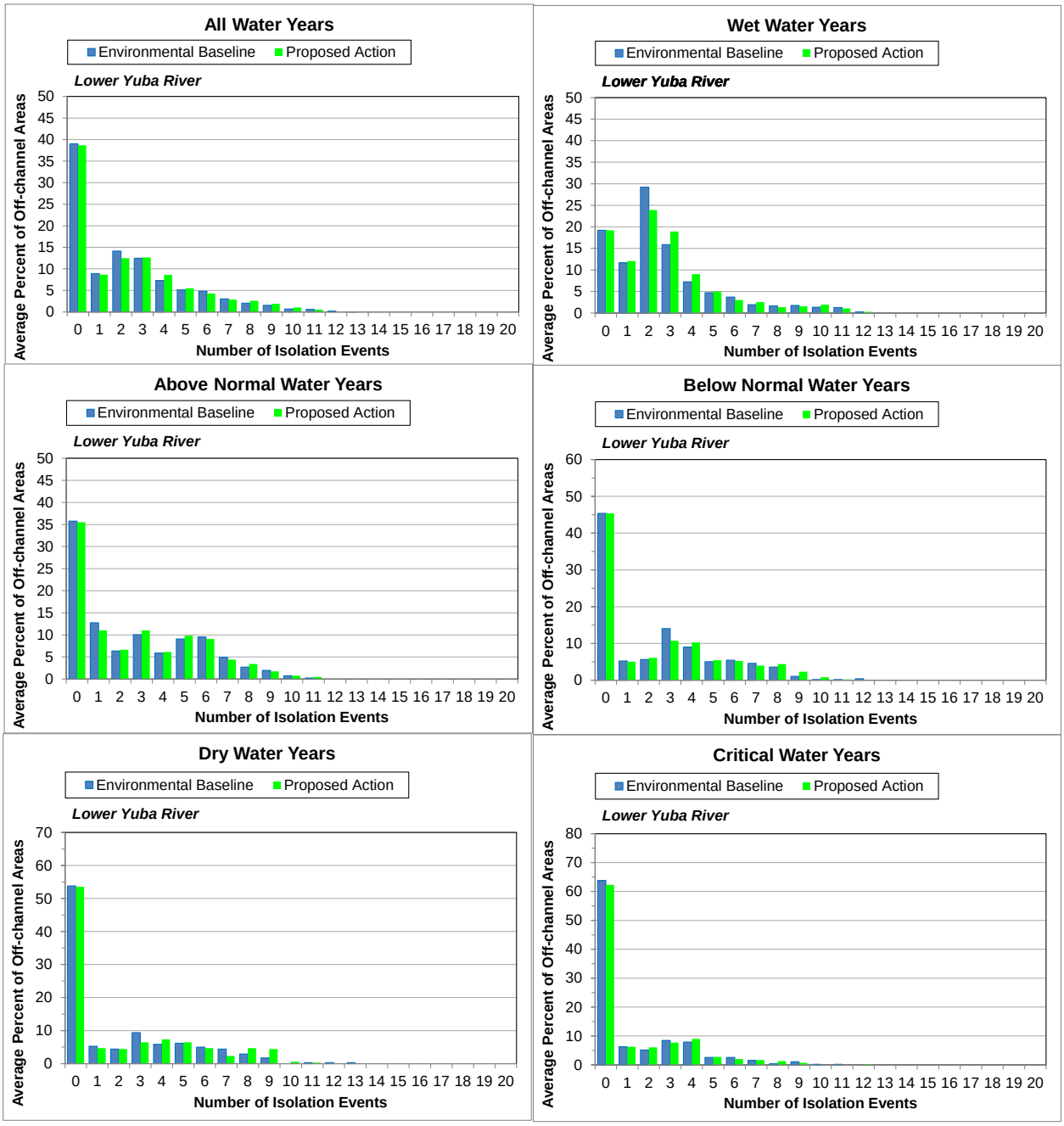

Figure 8.3-6. Frequency of off-channel area isolation events over the 41-year hydrologic period for the Proposed Action and Environmental Baseline scenarios.

During the one conference year (WY 1977) in the simulated period of evaluation (WY 1970-2010), the frequency of isolation events are very similar in frequency under the Proposed Action and Environmental Baseline scenarios.

Under the Environmental Baseline, fry and juvenile stranding and isolation is a stressor of moderate magnitude to spring-run Chinook salmon. Because the Proposed Action is anticipated to reduce the potential for stranding and isolation, the Proposed Action is expected to reduce the magnitude of this stressor, the potential "exposure" of spring-run Chinook salmon to this stressor, and the effects of this stressor on spring-run Chinook salmon critical habitat. Therefore, this stressor is expected to be reduced to a low to moderate magnitude stressor to spring-run Chinook salmon in the lower Yuba River under the Proposed Action.

8.3.1.1.2 Water Temperature

Proposed Action Compared to the Environmental Baseline

Table 8.3-8 displays the differences in spring-run Chinook salmon lifestage-specific WTI value exceedance probabilities under the Proposed Action scenario relative to the Environmental Baseline scenario (i.e., the probability of exceeding a WTI value under the Proposed Action scenario minus the probability of exceeding that WTI value under the Environmental Baseline scenario).

Table 8.3-8. Difference in simulated water temperature exceedance probabilities for spring-run Chinook salmon lifestages under the Proposed Action scenario relative to the Environmental Baseline scenario.

Spring-run Chinook Salmon Lifestage	Node	Upper Tolerable WTI Value	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Adult Immigration	SMRT	68°F							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
	Below DPD	68°F							0.0	0.0	0.0	0.0	0.0	0.2	-0.5	-1.4	-1.5	-0.3	-1.6	-2.3						
	MRY	68°F							0.0	0.0	0.0	0.2	0.3	0.3	0.2	0.0	0.0	0.0	0.0	0.0						
Adult Holding	SMRT	65°F							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
	Below DPD	65°F							0.0	0.0	0.0	0.0	0.3	0.5	0.0	0.0	0.0	0.0	-0.2	-0.2						
	MRY	65°F							0.0	0.0	0.0	0.8	1.1	2.6	4.4	3.5	2.8	3.2	2.3	0.3						
Spawning	SMRT	58°F																	0.0	0.0	0.0					
Embryo Incubation	SMRT	58°F																	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Juv. Rearing and Downstream Movmt.	Below DPD	65°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.5	0.0	0.0	0.0	0.0	-0.2	-0.2	-1.0	0.0	0.0	0.0	0.0	0.0
	MRY	65°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	1.1	2.6	4.4	3.5	2.8	3.2	2.3	0.3	0.0	0.2	0.0	0.0	0.0	0.0
Yearling+ Smolt Emigration	Below DPD	68°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0										0.0	0.0	0.0	0.0	0.0	0.0
	MRY	68°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0										-0.3	0.0	0.0	0.0	0.0	0.0

Water temperature exceedance probabilities are generally equivalent or very similar (i.e., difference in exceedance of <1 percent) under the Proposed Action and Environmental Baseline scenarios during the fall through spring months (i.e., October through May) for all lifestages of spring-run Chinook salmon. Some differences in simulated water temperatures occur during the spring-run Chinook salmon adult holding, and juvenile rearing and downstream movement lifestages. For all months of the year, no lifestage-specific WTI values are exceeded more often with a 10 percent or greater probability at any of the three evaluated locations under the Proposed Action scenario, relative to the Environmental Baseline scenario.

During the adult holding period extending from June through mid-September, water temperatures at the Marysville gage are somewhat higher under the Proposed Action scenario compared to the Environmental Baseline scenario. However, as previously discussed, adult spring-run Chinook salmon do not spend extended periods of time at downstream locations (e.g.,

Marysville), and they primarily exhibit holding behavior just downstream of Daguerre Point Dam or above Daguerre Point Dam.

During the juvenile rearing and downstream movement lifestage, which extends year-round, water temperatures during the summer at the Marysville gage are slightly higher under the Proposed Action compared to the Environmental Baseline. However, over the October 2006-mid 2016 monitoring period, measured water temperatures at Marysville never exceeded or reached 65°F during any time of the year, with the exception of two days during 2013, 23 days during 2014, and during approximately June through September 2015 (after a multi-year drought period). Also, exposure of downstream migrating juveniles during summer months to water temperatures at Marysville would not be expected to substantially occur, because only minimal outmigration occurs during the summer, and because rearing temperatures further upstream in this reach below Daguerre Point Dam are suitable.

During the one conference year (WY 1977) in the simulated period of evaluation (WY 1970-2010), water temperature differences between the Proposed Action and the Environmental Baseline scenarios demonstrate similar patterns among the three evaluation locations (Smartsville, Daguerre Point Dam and Marysville). Generally, water temperatures under the Proposed Action and the Environmental Baseline scenarios are very similar from October through July at Smartsville and Daguerre Point Dam, and from October through June at Marysville. After those dates, water temperature deviate between the Proposed Action and the Environmental Baseline, with Proposed Action water temperatures becoming increasingly cooler through the remainder of the year. The largest differences occur at Marysville, with water temperatures under the Proposed Action generally 6 to 10°F cooler during September.

During this conference year, these cooler water temperatures under the Proposed Action scenario would be more suitable water temperatures during the summer, which includes portions of the spring-run Chinook salmon adult immigration and holding, spawning, and juvenile rearing and downstream movement lifestages.

Overall, water temperatures under the Proposed Action are similar to those under the Environmental Baseline, and represent a low stressor to Yuba River spring-run Chinook salmon.

8.3.1.1.3 Narrows 2 Operations

Under the Proposed Action, proposed changes to Narrows 2 operations include changes to conference year flows, flow fluctuation criteria, and coordinated operations with the Narrows Project. Potential effects associated with Narrows 2 operations include redd dewatering and fry and juvenile stranding and isolation, as discussed above. The potential expressions of stressors (i.e., redd dewatering, fry and juvenile stranding and isolation, changes in flows and water temperatures, and flow-dependent habitat conditions) associated with Narrows 2 operations are evaluated independently.

Project FERC relicensing studies (Technical Memorandum 7-11, *Fish Behavior and Hydraulics Near Narrows 2 Powerhouse*, can be found on FERC's eLibrary as referenced by the FERC accession number provided in Table E6-2 of Appendix E6, of YCWA's Amended FLA)

conducted to date indicate that adult anadromous salmonids (presumably including spring-run Chinook salmon) have not been observed entering the draft tube of Narrows 2. Additional analyses regarding Narrows 2 operations and fish movement prepared for this Applicant-Prepared Draft BA indicate that Narrows 2 flow releases do not appear to adversely influence adult spring-run Chinook salmon upstream migration, holding or spawning in the Yuba River upstream of Daguerre Point Dam. Potential effects appear to be localized to the proximate vicinity of Narrows 2 facilities. Technical Memorandum 7-11a (which can be found on FERC's eLibrary as referenced by the FERC accession number provided in Table E6-2 of Appendix E6, of YCWA's Amended FLA) examined fine-scale movements of adult Chinook salmon in the Yuba River downstream of the Narrows 2 Powerhouse to just upstream of the Narrows 1 Powerhouse. Acoustic telemetry was used to track adult Chinook salmon from August until late October of 2015 under two operational conditions; flow from the Full Bypass, and no discharge from any Narrows 2 facilities. GIS analysis of fish positions indicated little difference in fish behavior between the two operational conditions (i.e., none of the Narrows 2 Facilities operating, and only the Full Bypass operating) observed. Based on the studies conducted for Technical Memorandum 7-11/7-11a, it is apparent that the conditions present in the vicinity of the Narrows 2 Powerhouse, while variable and often dynamic, are within the boundaries of adult Chinook salmon tolerance.

Potential effects to adult spring-run Chinook salmon appear to be localized to the proximate vicinity of the Narrows 2 facilities. Narrows 2 operations have the potential to adversely affect adult spring-run Chinook salmon holding. There have been observations of adult Chinook salmon apparently confined in an isolated pool in the channel near Narrows 2 Powerhouse. Measures have been taken to physically restructure the potential isolation areas, and monitoring, reporting and fish rescue procedures have been developed. Under the Environmental Baseline, Narrows 2 operations are characterized as a low stressor, and would remain a low stressor to spring-run Chinook salmon under the Proposed Action.

8.3.1.1.4 Riparian Habitat and Instream Cover (Riparian Vegetation, Instream Woody Material)

The Amended FLA includes a condition to limit the amount of flow reduction (2.5 cm/day) from one day to the next to promote riparian vegetation seedling establishment during the period of April 1 through July 15. The initiation of this period (April 1) was established based upon the USFWS/Cal Fish and Wildlife (October 2015) proposal. The July 15 ending date was established based on the date after which uncontrolled flows would not be expected to occur each year (i.e., no storm-induced precipitation or snowmelt runoff requiring ramp-down). Reedy et al. (2016) identified a maximum recession rate of 2.5 cm/day, citing recommendations by Mahoney and Rood (1998) and Stella et al. (2006), for riparian vegetation seedling establishment.

The flow reduction measure applies to day-to-day release reductions when the previous day's flow is at or below 4,130 cfs, which is the combined release capacity of the Narrows 2 and Narrows 1 powerhouses, as measured at the Smartsville gage. Table 8.3-9 specifies the maximum daily flow reductions during April 1 through July 15 that apply for specified ranges of previous day flow.

Table 8.3-9. Allowable maximum flow reductions from the previous day average flow during the period extending from April 1 through July 15 (from Table 3 in AR9).

Previous Day Average Flow Range (cfs)	Maximum Flow Reduction (cfs)
400 - 999	79
1,000 – 1,999	150
2,000 – 4,130	200

Daily flows under the Proposed Action and the Environmental Baseline were modeled over the entire simulation period (1970-2010). The Proposed Action scenario includes all of the measures in the Amended FLA, including the riparian vegetation recession flow rate reduction limits.

Evaluation of stage change reductions were conducted for the Parks Bar Reach on the lower Yuba River. The Parks Bar Reach was selected as an indicator of stage change on the lower Yuba River because it: 1) is a relatively long reach (4.7 mi); 2) is located about mid-way between Englebright and Daguerre Point dams; and 3) exhibits an intermediate stage-discharge relationship relative to other reaches (Strom et al. 2016 as cited in Reedy et al. 2016).

Under the Environmental Baseline, day-to-day stage reductions of greater than 2.5 cm occurred during 346 days, compared to 279 days under the Proposed Action, out of the 4,346 days included in the period of evaluation (106 days per year for the 41-year simulation period). Therefore, the flow reduction rate limitation included in the Proposed Action resulted in a nearly 20 percent reduction in the number of days exceeding the 2.5 cm/day criterion. For context, the Without-Project scenario would result in 822 days exceeding the 2.5 cm/day flow reduction criterion, or almost 3 times more days than the Proposed Action.

The flow reduction criteria are only implemented for a portion of the entire evaluation period, because managed releases only occur up to the combined capacity of Narrows 1 and Narrows 2, which is 4,130 cfs. Because the criterion is only applied on some of the days, stage reductions greater than the target maximum reduction of 2.5 cm/day still occur. Also, the criterion is applied at the Smartsville gage location, which is located just downstream of the Narrows 1 and Narrows 2 powerhouses. Downstream of the gage, Deer Creek flows, which are mostly unregulated, enter the lower Yuba River. Flow changes from this tributary affects the amount of stage change downstream in the Yuba River.

Figure 8.3-7 is an exceedance probability plot of the amount of stage reduction per day for the Proposed Action and the Environmental Baseline. The exceedance distributions demonstrate the probability of occurrence (percent) of stage reductions exceeding a specified daily amount. They include the full range of daily flow reduction rates (cm/day) and are not limited to days when flows are less than 4,130 cfs. Approximately 10 percent of the time the Proposed Action results in lower rates of flow reduction (cm/day) than the Environmental Baseline. From April 1 through July 15 over the 41-year evaluation period, the Proposed Action would result in a flow reduction rate of 2.5 cm/day or less about 89 percent of the time, compared to 86 percent of the time under the Environmental Baseline.

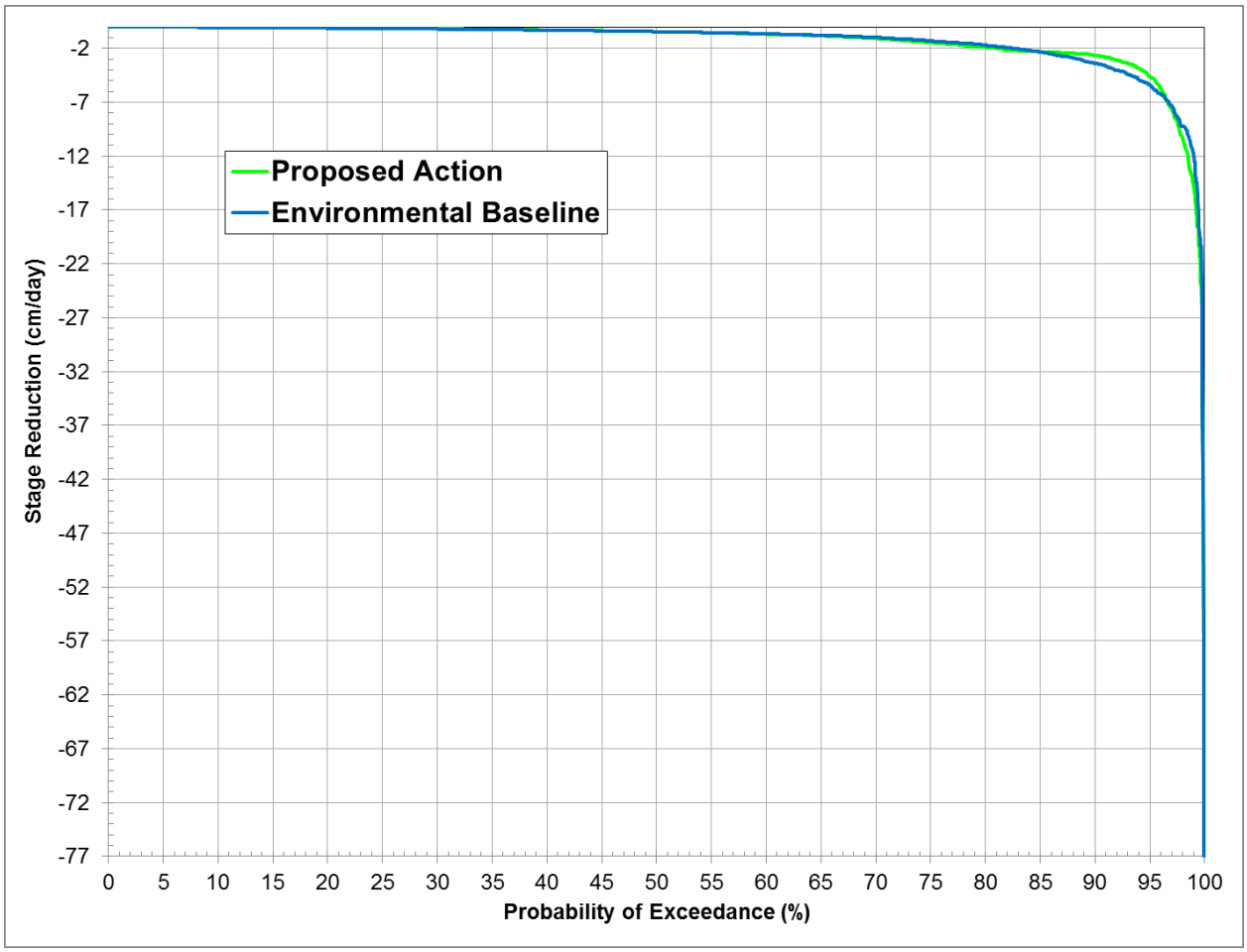

Figure 8.3-7. Exceedance probability of specified daily stage reductions (cm/day) from April 1 through July 15 under the Proposed Action and the Environmental baseline over the 41-year period of evaluation.

Riparian vegetation seedling establishment recession rates are somewhat improved under the Proposed Action relative to the Environmental Baseline. Because spring recession rates of 2.5 cm/day or less are estimated to occur about 89 percent of the time, riparian vegetation recession rates represent a low stressor under the Proposed Action.

Under the Environmental Baseline, riparian vegetation and LWM, related primarily to the historical effects of upstream hydraulic mining on the channel geomorphology, and the existence of multiple large dams upstream, provide reduced habitat complexity and diversity, which potentially limits the productivity of juvenile salmonids. The limited availability of riparian habitat and instream cover (in the form of LWM) is a stressor that is manifested every year. Consequently, it was concluded that riparian habitat and instream cover are a stressor of moderate to high magnitude to Yuba River juvenile spring-run Chinook salmon. Under the Proposed Action, implementation of YCWA's Proposed Condition AR9, *Control Project Ramping and Flow Fluctuation Downstream of Englebright Dam*, is expected to eventually improve riparian vegetation recruitment by restricting flow reductions during the riparian

vegetation seedling establishment period to rates proposed by USFWS/Cal Fish and Wildlife (October 2015) of a stage decrease less than 2.5 cm/day. However, in consideration of the slight improvement to riparian vegetation establishment provided by condition AR9, and in consideration of the timeframe required for riparian vegetation establishment, under the Proposed Action riparian habitat and instream cover would continue to represent a moderate to high stressor to juvenile spring-run Chinook salmon.

8.3.1.1.5 Other Stressors

Stressors and their magnitudes, other than those associated with flow-dependent effects described above, to spring-run Chinook salmon in the lower Yuba River under the Proposed Action that are the same as under the Environmental Baseline are presented in Table 8.3-10. Stressors that are different under the Proposed Action than under the Environmental Baseline are described immediately below.

Table 8.3-10. Non-flow dependent or water temperature stressors and associated magnitudes to spring-run Chinook salmon in the lower Yuba River under both the Environmental Baseline and the Proposed Action.

Stressor	Relative Magnitude
Passage Impediments/Barriers	
• Englebright Dam	Very High
• Daguerre Point Dam	High
Harvest/Angling	Low
Poaching	High
Hatchery Effects (genetic considerations and straying)	High
Physical Habitat Alteration (Waterway 13 and Lake Wildwood)	Low to Moderate
Fry and Juvenile Rearing Physical Habitat Structure	High
Entrainment	
• BVID diversion	Low
• Hallwood-Cordua and South Yuba/Brophy diversions	Low
Predation	Moderate to High
Natural River Morphology and Function	High
Floodplain Habitat Availability	High

8.3.1.2 Steelhead

Flow-dependent analyses in this Applicant-Prepared Draft BA used modeled flows and water temperatures to quantify spawning habitat availability, potential redd dewatering, fry and juvenile rearing habitat availability, potential juvenile isolation, and lifestage-specific water temperature suitabilities for steelhead. Methods to conduct the flow-dependent analyses were the same as those described in Section 6.0. Each of these considerations are evaluated under the

Proposed Action, and their relative magnitudes as stressors to steelhead in the lower Yuba River are presented.

8.3.1.2.1 Flow-Dependent Habitat Conditions

Spawning Habitat

Spawning WUA for steelhead was evaluated for simulated flows up to 5,000 cfs, which generally represents the bankfull flow in the lower Yuba River. During the January through April steelhead spawning period, flows exceed 5,000 cfs during about 21 percent of the days over the 41-year simulation period for both the Proposed Action and the Environmental Baseline, which were excluded from the steelhead spawning WUA analysis. Table 8.3-11 displays the long-term average and average by WYT of steelhead spawning WUA (percent of maximum) under the Proposed Action and Environmental Baseline scenarios.

Table 8.3-11. Long-term and water year type average steelhead spawning WUA (percent of maximum) under the Proposed Action and Environmental Baseline.

Scenario	Long-term Full Simulation Period[2]	WYTs[1]				
		Wet	Above Normal	Below Normal	Dry	Critical
Proposed Action	92.4	97.5	96.4	93.9	91.6	84.0
Environmental Baseline	92.4	97.6	96.4	94.0	91.2	83.9
Difference	0.0	-0.1	0.0	-0.1	0.4	0.1

[1] As defined by the Yuba River Index (YRI) WY Hydrologic Classification.
[2] Based on the WY 1970-2010 simulation period.

Over the entire 41-year simulation period, the long-term average steelhead spawning habitat availability (WUA) in the lower Yuba River is the same under the Proposed Action relative to the Environmental Baseline (92.4 percent of maximum WUA). The Proposed Action scenario results in a similar amounts of spawning WUA by WYT as the Environmental Baseline scenario. As with the Environmental Baseline scenario, the Proposed Action scenario provides an average of over 80 percent of maximum spawning WUA during all WYTs.

Habitat durations for steelhead spawning under the Proposed Action and Environmental Baseline scenarios are presented in Figure 8.3-8.

The Proposed Action scenario provides similar amounts of spawning habitat availability compared to the Environmental Baseline scenario over nearly the entire exceedance distribution. Both the Proposed Action and Environmental Baseline provide more than 80 percent of maximum WUA with about an 85 percent probability.

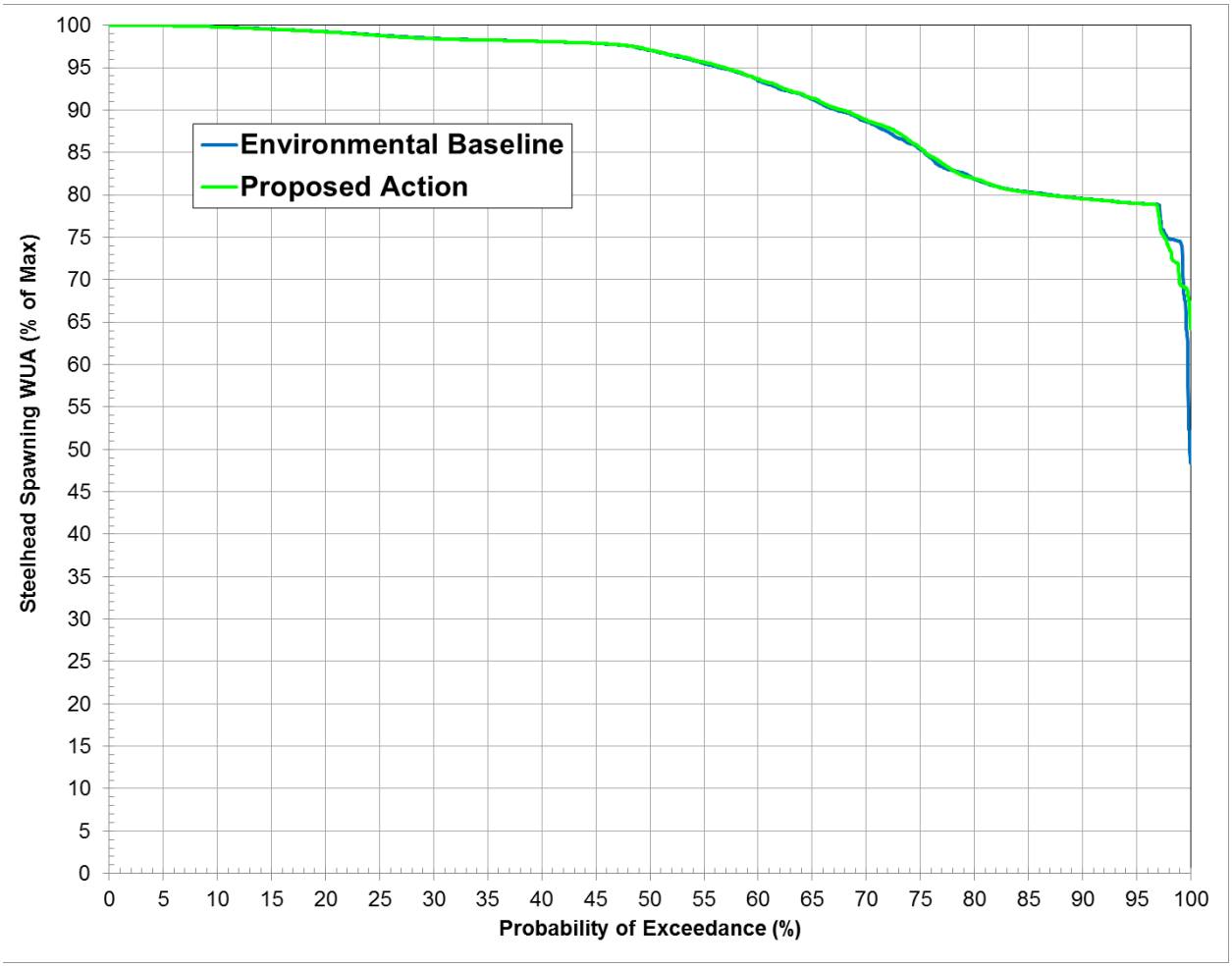

Figure 8.3-8. Steelhead spawning habitat duration over the 41-year hydrologic period for the Proposed Action and Environmental Baseline scenarios.

During the one conference year (WY 1977) in the simulated period of evaluation (WY 1970-2010), the Proposed Action and the Environmental Baseline provide similar amounts of steelhead spawning habitat (73.8 percent and 73.6 percent of maximum WUA, respectively).

Flow-dependent spawning habitat availability under the Proposed Action scenario is estimated to be very similar to that under the Environmental Baseline. Flow-dependent spawning habitat availability under the Proposed Action represents a low stressor to steelhead.

Potential Redd Dewatering

Since the development of the existing flow fluctuation criteria, additional data and information have been collected and models have been developed to better analyze the potential for steelhead redd dewatering in the Yuba River (see Section 6.0 of this Applicant-Prepared Draft BA). Proposed new flow fluctuation criteria were developed for the Proposed Action (see Proposed

Condition AR9, *Control Project Ramping and Flow Fluctuation Downstream of Englebright Dam*, in Amended Appendix E2 of the Amended FLA).

The long-term annual average and the average by WYT of steelhead redds potentially dewatered under the Proposed Action is very similar to that under the Environmental Baseline (Table 8.3-12).

Table 8.3-12. Estimated steelhead redd and egg pocket potential dewatering under the Proposed Action relative to the Environmental Baseline.

WYT Categories	Redd Dewatering Index (%)			Egg Pocket Dewatering Index (%)		
	Proposed Action	Environmental Baseline	Difference	Proposed Action	Environmental Baseline	Difference
Long-term (All WYs)	19.28%	19.17%	0.11%	9.69%	9.54%	0.15%
Wet	36.56%	35.91%	0.65%	20.32%	20.04%	0.28%
Above Normal	16.63%	17.16%	-0.53%	6.80%	6.82%	-0.02%
Below Normal	15.10%	14.87%	0.23%	6.17%	5.89%	0.28%
Dry	3.76%	4.42%	-0.66%	0.72%	0.75%	-0.03%
Critical	2.20%	2.26%	-0.06%	0.62%	0.58%	0.04%

The long-term average and the average by WYT of potential egg pocket dewatering is similar under the Proposed Action and the Environmental Baseline scenarios.

During the one conference year (WY 1977) in the simulated period of evaluation (WY 1970-2010), no steelhead redds would potentially be dewatered under the Proposed Action, compared to an estimated 1.25 percent of redds under the Environmental Baseline. During this conference year, no egg pockets would be dewatered under either the Proposed Action or Environmental Baseline.

The potential redd dewatering for steelhead is primarily due to high flow events (storm flows), which exceed the combined total flow capacity at Narrows 1 and Narrows 2 (4,130 cfs) that occur during the steelhead spawning and incubation period (i.e., January through May), and due to redd dewatering during those days when the conditions associated with Proposed Condition AR9 would not apply. Consequently, potential steelhead redd dewatering under the Proposed Action is estimated to be similar to that under the Environmental Baseline, and would not be exacerbated by the Proposed Action.

Proposed Condition AR9, Control Project Ramping and Flow Fluctuation Downstream of Englebright Dam, was developed in part to minimize the potential for steelhead redd dewatering, during the period from January 1 through May 31 (corresponding to the steelhead spawning and incubation period). Under this proposed condition, Licensee shall not reduce the flow downstream of Englebright Dam to less than the larger of: 1) the applicable minimum streamflow requirement specified in YCWA's Proposed Condition AR3; or 2) the flow that would result from applying the maximum flow reduction amount specified in Table 2 of this condition corresponding to the base flow range determined using the maximum 5-day average flow that occurred on days when this condition was in effect during that January 1 through May

31 period. During the period of January 1 through 5, the base flow range under this proposed condition shall be determined by the average daily flow on December 31. If this proposed condition is not in effect on December 31, then the base flow range shall be the minimum flow authorized under the preceding paragraph on the latest date on which this condition was in effect. During the period from April 1 through May 31 when Flow Schedules 3 through 6 or Conference Years specified in YCWA's Proposed Condition WR3 are in effect, the proposed condition would allow Licensee to reduce the flow downstream of Englebright Dam to the applicable minimum streamflow requirement specified in YCWA's Proposed Condition AR3.

During the days over the 41-year period of evaluation when this proposed condition would apply, it would provide the intended protection for steelhead redd dewatering (Table 8.3-13).

Table 8.3-13. Estimated steelhead redd and egg pocket potential dewatering under the Proposed Action relative to the Environmental Baseline, for those days in the 41-year period of record during which the flow reduction criteria specified in Proposed Condition AR9 would apply.

WYT Categories	Redd Dewatering Index (%)			Egg Pocket Dewatering Index (%)		
	Proposed Action	Environmental Baseline	Difference	Proposed Action	Environmental Baseline	Difference
Long-term (All WYs)	0.43%	0.43%	0.00%	0.06%	0.05%	0.01%
Wet	0.26%	0.19%	0.07%	0.01%	0.01%	0.00%
Above Normal	0.38%	0.45%	-0.07%	0.07%	0.08%	-0.01%
Below Normal	0.12%	0.14%	-0.02%	0.01%	0.01%	0.00%
Dry	0.41%	0.39%	0.02%	0.06%	0.04%	0.02%
Critical	1.07%	1.14%	-0.07%	0.18%	0.17%	0.01%

Fry and Juvenile Rearing Habitat Availability

Steelhead Fry Rearing In-Channel Habitat

Table 8.3-14 displays the long-term average and average by WYT of steelhead fry in-channel rearing WUA (percent of maximum) under the Proposed Action and Environmental Baseline scenarios.

Table 8.3-14. Long-term and WYT average steelhead fry in-channel rearing WUA (percent of maximum) under the Proposed Action and Environmental Baseline scenarios.

Scenario	Long-term Full Simulation Period[2]	WYTs[1]				
		Wet	Above Normal	Below Normal	Dry	Critical
Proposed Action	83.1	81.8	82.0	81.5	83.9	86.7
Environmental Baseline	83.0	81.8	82.1	81.5	84.0	86.0
Difference	0.1	0.0	-0.1	0.0	-0.1	0.7

[1] As defined by the Yuba River Index (YRI) WY Hydrologic Classification.
[2] Based on the WY 1970-2010 simulation period.

During the April through July steelhead fry rearing period, flows exceed 5,000 cfs during about 12 percent of the days over the 41-year simulation period for the Proposed Action and Environmental Baseline scenarios. These days were excluded from the steelhead fry in-channel rearing WUA analysis.

Over the entire 41-year simulation period, long-term average fry in-channel rearing WUA in the lower Yuba River is very similar under the Proposed Action and Environmental Baseline scenarios (long-term average of 83.1 percent and 83.0 percent of maximum WUA, respectively). The Proposed Action scenario results in very similar amounts offry in-channel rearing habitat (maximum WUA) during all WYs, with the exception of critical WYs, when the Proposed Action provides 0.7 percent more habitat than the Environmental Baseline. Neither the Proposed Action scenario or Environmental Baseline scenario provides over 90 percent of maximum fry in-channel rearing WUA during any WYT, although both scenarios provide over 80 percent of maximum in-channel rearing WUA during all WYTs.

Habitat duration for steelhead fry rearing under the Proposed Action and Environmental Baseline scenarios is presented in Figure 8.3-9. The Proposed Action and Environmental Baseline scenarios provide mostly similar or higher amounts of fry in-channel rearing habitat availability over nearly the entire exceedance distribution. The Proposed Action and Environmental Baseline scenarios achieve 80 percent or more of maximum fry in-channel rearing WUA with about a 72 percent probability.

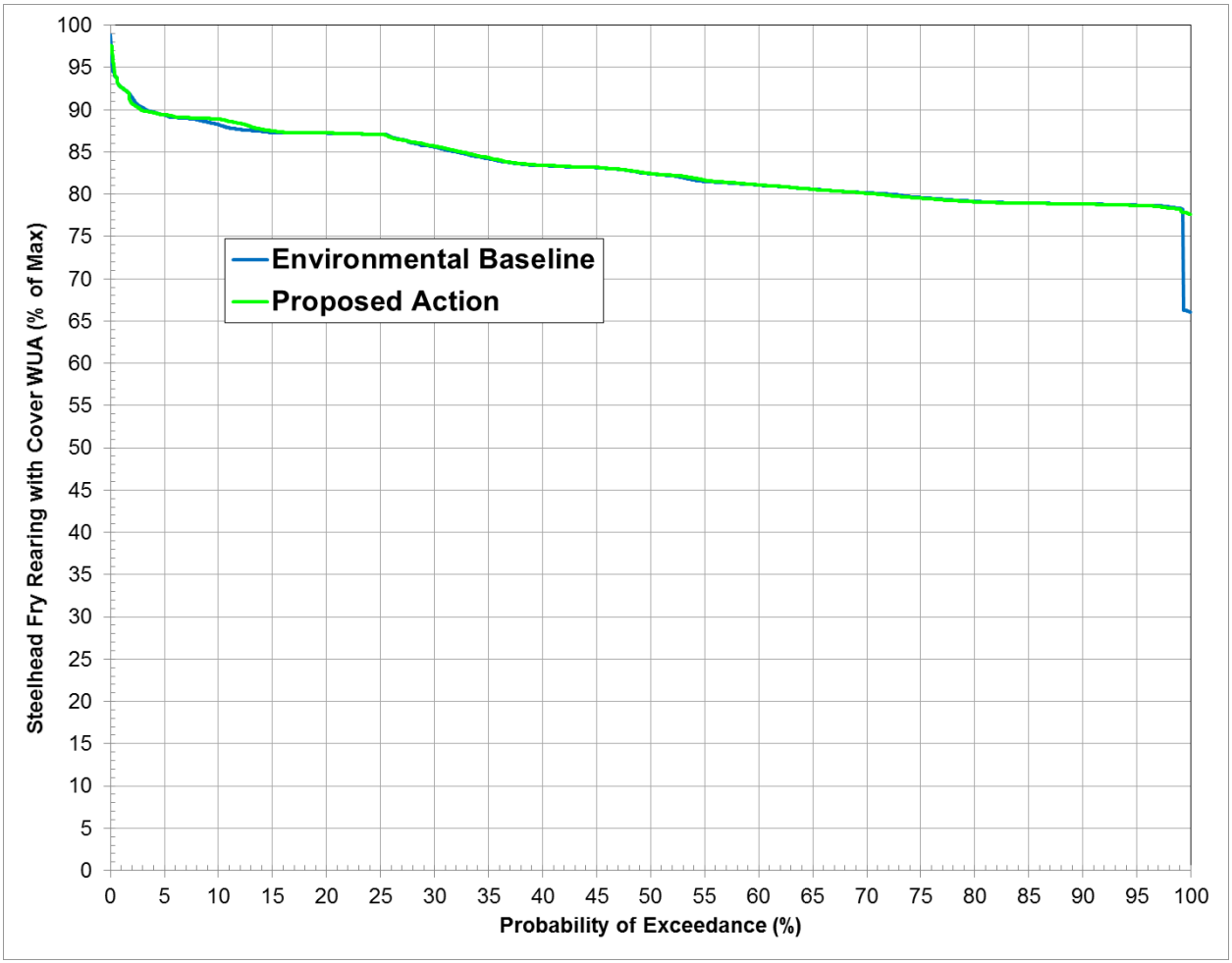

Figure 8.3-9. Steelhead fry in-channel rearing habitat duration over the 41-year hydrologic period for the Proposed Action and Environmental Baseline scenarios.

There is one conference year (WY 1977) in the simulated period of evaluation (WY 1970-2010). The corresponding steelhead fry rearing period extends from April through July of 1977. Duirng that fry rearing season, 87.6 percent of steelhead maximum fry in-channel rearing WUA was provided under the Proposed Action scenario compared to 86.2 percent provided under the Environmental Baseline scenario.

Steelhead Fry Rearing Full Flow Habitat

Table 8.3-15 displays the full-flow analysis of the average amounts (ac) of steelhead fry WUA without cover under the Proposed Action and the Environmental Baseline scenarios over the 41-year period of evaluation. Results are shown for all days, for days when flows were less than or equal to 5,000 cfs and for days when flows were greater than 5,000 cfs, and the differences between the two scenarios over the long-term full simulation period (all years) and by WYT.

Table 8.3-15. Long-term average WUA (ac) over the 41-year period of evaluation and WYT-specific relative contribution to the long-term average WUA of steelhead fry rearing habitat, under the Proposed Action and the Environmental Baseline.

Scenario	Long-term Full Simulation Period[2]	WYTs[1]				
		Wet	Above Normal	Below Normal	Dry	Critical
Proposed Action						
Total Days in Analysis	**5,002**	**1,830**	**732**	**854**	**610**	**976**
Days ≤ 5,000 cfs	4,348	1,308	653	805	609	973
Days > 5,000 cfs	654	522	79	49	1	3
Avg. WUA	**169.5**	**62.8**	**23.5**	**27.4**	**20.6**	**35.0**
WUA ≤ 5,000 cfs	143.0	41.2	20.6	25.6	20.6	34.9
WUA > 5,000 cfs	26.5	21.6	2.9	1.8	0.0	0.1
Environmental Baseline						
Total Days in Analysis	**5,002**	**1,830**	**732**	**854**	**610**	**976**
Days ≤ 5,000 cfs	4,400	1,341	664	809	610	976
Days > 5,000 cfs	602	489	68	45	0	0
Avg. WUA	**169.1**	**62.7**	**23.6**	**27.4**	**20.7**	**34.7**
WUA ≤ 5,000 cfs	144.4	42.3	21.0	25.8	20.7	34.7
WUA > 5,000 cfs	24.7	20.5	2.6	1.7	0.0	0.0
Differences						
Avg. WUA	**0.4**	**0.1**	**0.0**	**0.0**	**0.0**	**0.4**
% change	**0.2%**	**0.1%**	**-0.1%**	**-0.1%**	**-0.2%**	**1.1%**

[1] As defined by the Yuba River Index (YRI) WY Hydrologic Classification.
[2] Based on the WY 1970-2010 simulation period.

For the entire simulation period, generally similar amounts of fry rearing habitat (average WUA) are available under the Proposed Action compared to the Environmental Baseline. The Proposed Action results in very similar amounts of fry rearing habitat during all WYs, except during critical WYs when the Proposed Action provides 1.1 percent more habitat than under the Environmental Baseline.

Figure 8.3-10 displays the full-flow analysis of the average amounts (ac) of steelhead fry weighted usable area (WUA) without cover under the Proposed Action and the Environmental Baseline. For both scenarios, the highest average spring-run Chinook salmon fry habitat occurred during wet WYs, followed by critical WYs and with lesser amounts during above normal, below normal, and dry WYTs. For both the Proposed Action and Environmental Baseline, relatively little to no additional fry rearing habitat is provided by days when flows were > 5,000 cfs for dry and critical WYTs.

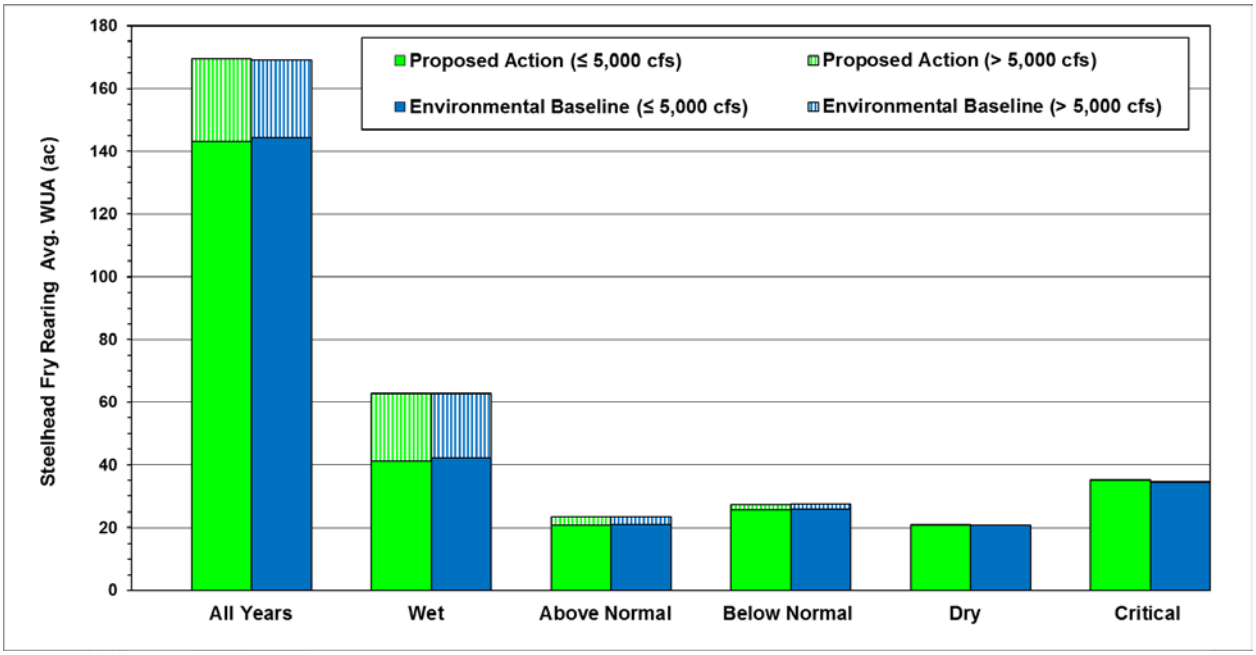

Figure 8.3-10. Comparison of the average amount (ac) of steelhead fry weighted usable area (WUA) without cover under the Proposed Action and the Environmental Baseline over the 41-year period of evaluation. Shown are the amounts over the long-term full simulation period (all years) and by water year type of habitat provided on days when flows were ≤ 5,000 cfs and for days when flows were > 5,000 cfs.

Steelhead Juvenile Rearing In-Channel Habitat

During the year-round steelhead juvenile rearing period, flows exceed 5,000 cfs during about 11 percent of the days over the 41-year simulation period for the Proposed Action, and during about 10 percent of the days under the Environmental Baseline. These days were excluded from the steelhead juvenile in-channel rearing WUA analysis.Table 8.3-16 displays the long-term average and average by WYT of steelhead juvenile in-channel rearing WUA (percent of maximum) under the Proposed Action and Environmental Baseline scenarios.

Table 8.3-16. Long-term and WYT average steelhead juvenile in-channel rearing WUA (percent of maximum) under the Proposed Action and Environmental Baseline scenarios.

Scenario	Long-term Full Simulation Period[2]	WYTs[1]				
		Wet	Above Normal	Below Normal	Dry	Critical
Proposed Action	96.7	95.7	95.8	96.8	98.1	98.0
Environmental Baseline	96.6	95.6	95.8	96.8	98.1	97.4
Difference	0.1	0.1	0.0	0.0	0.0	0.6

[1] As defined by the Yuba River Index (YRI) WY Hydrologic Classification.
[2] Based on the WY 1970-2010 simulation period.

Over the entire 41-year simulation period, long-term average juvenile in-channel rearing WUA in the lower Yuba River is very similar under the Proposed Action and Environmental Baseline scenarios (long-term average of 96.7 percent versus 96.6 percent of maximum WUA). The Proposed Action scenario also results in very similar maximum fry rearing habitat during all WYTs, with the exception of critical WYs, when the Proposed Action scenario provides 0.6 percent more fry rearing habitat relative to the Environmental Baseline scenario. Both the Proposed Action and Environmental Baseline scenarios provide an average of 80 percent (and even 95 percent) or more of juvenile in-channel rearing maximum WUA during all WYTs.

Habitat duration for steelhead juvenile in-channel rearing under the Proposed Action and Environmental scenarios is presented in Figure 8.3-11. The Proposed Action and Environmental Baseline scenarios provide very similar amounts of juvenile rearing habitat availability over the entire exceedance distribution. The Proposed Action and Environmental Baseline scenarios both achieve 80 percent (and even 90 percent) or more of juvenile in-channel rearing maximum WUA with about a 99 percent probability.

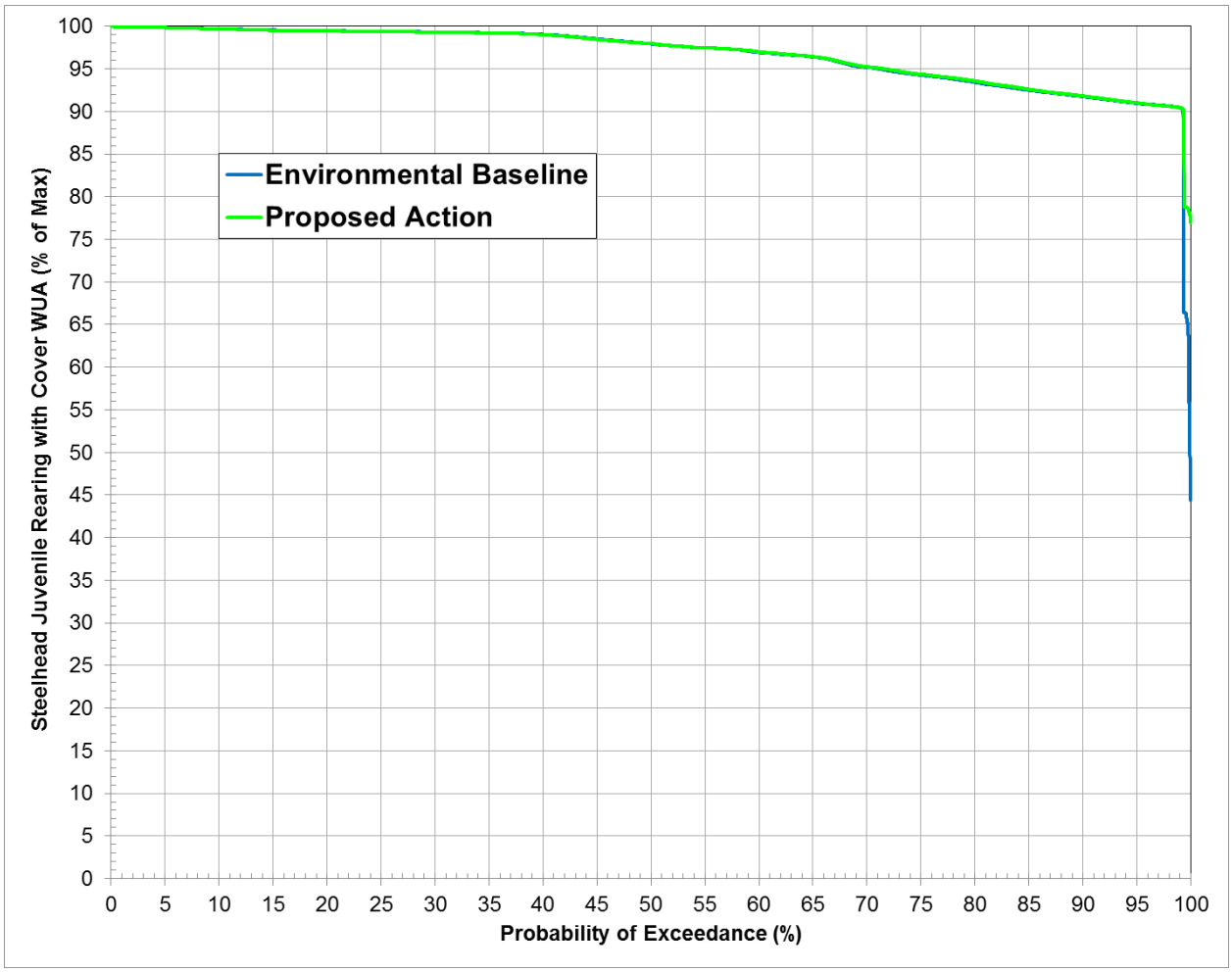

Figure 8.3-11. Steelhead juvenile in-channel rearing habitat duration over the 41-year hydrologic period for the Proposed Action and Environmental Baseline scenarios.

During the one conference year (WY 1977) in the simulated period of evaluation (WY 1970-2010), 93.1 percent of steelhead juvenile in-channel rearing maximum WUA was provided under the Proposed Action compared to 88.3 percent provided under the Environmental Baseline.

Steelhead Juvenile Rearing Full-Flow Habitat

Table 8.3-17 displays the full-flow analysis of the average amounts (ac) of steelhead juvenile WUA without cover under the Proposed Action and the Environmental Baseline over the 41-year period of evaluation. Very similar amounts of juvenile rearing habitat (avearage WUA) are provided under the Proposed Action and the Environmental Baseline for the entire simuation period and all WYTs, with the exception of critical WYs when 0.8 percent more habitat was provided under the Proposed Action.

Table 8.3-17. Long-term average WUA (ac) over the 41-year period of evaluation and WYT-specific relative contribution to the long-term average WUA of steelhead juvenile rearing habitat, under the Proposed Action and the Environmental Baseline.

Scenario	Long-term Full Simulation Period[2]	WYTs[1]				
		Wet	Above Normal	Below Normal	Dry	Critical
Proposed Action						
Total Days in Analysis	**14,974**	**5,477**	**2,191**	**2,557**	**1,826**	**2,923**
Days ≤ 5,000 cfs	13,387	4,175	2,002	2,468	1,823	2,919
Days > 5,000 cfs	1,587	1,302	189	89	3	4
Avg. WUA	**260.2**	**94.5**	**36.7**	**43.9**	**32.4**	**52.7**
WUA ≤ 5,000 cfs	229.8	69.1	33.4	42.3	32.3	52.6
WUA > 5,000 cfs	30.5	25.4	3.4	1.6	0.1	0.1
Environmental Baseline						
Total Days in Analysis	**14,974**	**5,477**	**2,191**	**2,557**	**1,826**	**2,923**
Days ≤ 5,000 cfs	13,411	4,198	2,003	2,468	1,823	2,919
Days > 5,000 cfs	1,563	1,279	188	89	3	4
Avg. WUA	**259.7**	**94.4**	**36.7**	**43.9**	**32.4**	**52.3**
WUA ≤ 5,000 cfs	229.7	69.4	33.4	42.3	32.4	52.2
WUA > 5,000 cfs	30.0	25.0	3.3	1.5	0.0	0.1
Differences						
Avg. WUA	**0.5**	**0.1**	**0.0**	**0.0**	**0.0**	**0.4**
% change	**0.2%**	**0.1%**	**0.0%**	**0.0%**	**-0.1%**	**0.8%**

[1] As defined by the Yuba River Index (YRI) WY Hydrologic Classification.
[2] Based on the WY 1970-2010 simulation period.

Figure 8.3-12 displays the full-flow analysis of the average amounts (ac) of steelhead juvenile WUA without cover under the Proposed Action and the Environmental Baseline. For both scenarios, the highest average spring-run Chinook salmon fry habitat occurred during wet WYs, followed by critical WYs and with lesser amounts during above normal, below normal, and dry WYTs. For both the Proposed Action and the Environmental Baseline, relatively little to no additional juvenile rearing habitat is provided by days when flows were > 5,000 cfs for dry and critical WYTs.

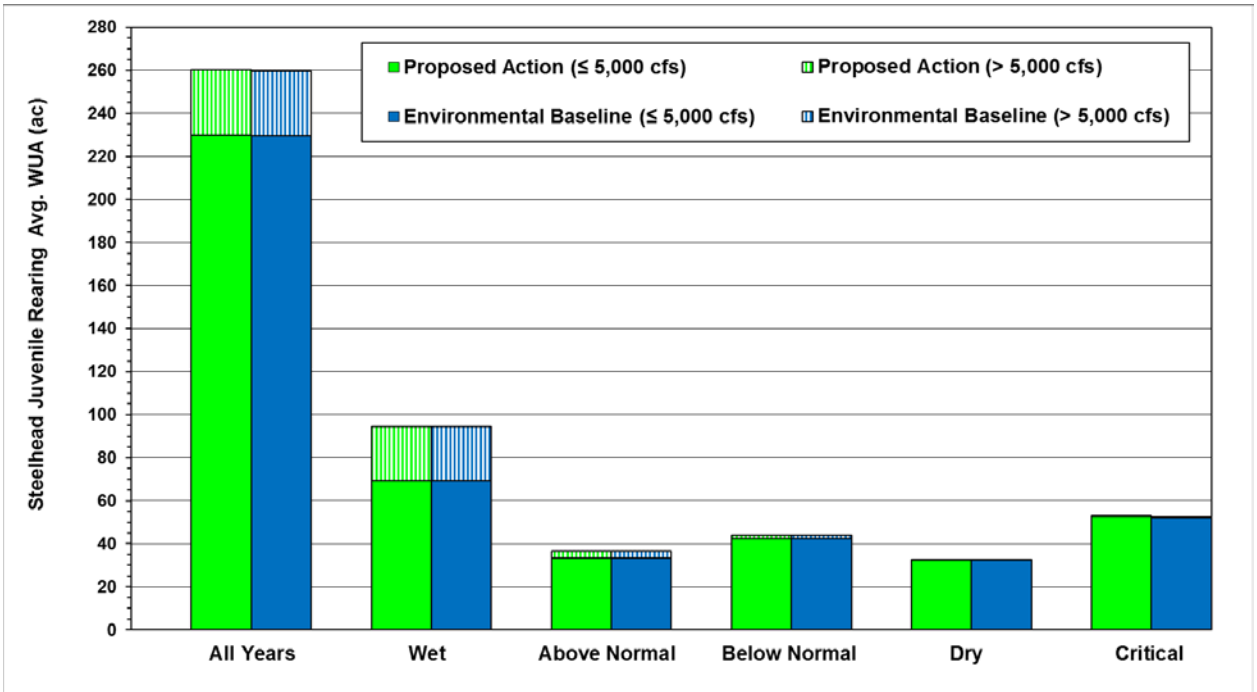

Figure 8.3-12. Comparison of the average amount (ac) of steelhead juvenile weighted usable area (WUA) without cover under the Proposed Action and the Environmental Baseline over the 41-year period of evaluation. Shown are the amounts over the long-term full simulation period (all years) and by WYT of habitat provided on days when flows were ≤ 5,000 cfs and for days when flows were > 5,000 cfs.

Fry and Juvenile Rearing Habitat as Stressors

Steelhead flow-dependent fry and juvenile rearing habitat availability under the Proposed Action is very similar to that under the Environmental Baseline. Flow-dependent fry and juvenile rearing habitat availability under the Proposed Action represents a low stressor to steelhead.

As a stressor, flow-dependent rearing habitat availability is distinct from rearing habitat physical structure. 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, continues to be a high stressor to rearing juvenile anadromous salmonids. Fry and juvenile rearing physical habitat structure under the Environmental Baseline is a high stressor to Yuba River steelhead, and will remain a high stressor under the various scenarios evaluated in this Applicant-Prepared Draft BA, including the Proposed Action.

Fry and Juvenile Stranding and Isolation

Fry Stranding

The proposed lower maximum authorized decrease in ramping rate, from 500 cfs per hour under RD-1644 and YCWA's existing FERC license, to 200 cfs per hour under the Proposed Action is anticipated to minimize potential effects to juvenile salmonids associated with stranding in the lower Yuba River. In addition, the proposed lower maximum authorized ramping rate is similar to ramping rates specified for other Central Valley rivers, which generally correspond to recommendations described in WDF (1992) that suggest reductions in river stage of 1-2 in per hour are protective.

Juvenile Isolation

The ramping rate reduction under the Proposed Action also is anticipated to reduce the potential for juvenile isolation in the lower Yuba River, relative to the Environmental Baseline. The lower maximum authorized ramping rates may better allow juvenile salmonids to volitionally move out of off-channel areas.

As previously discussed for spring-run Chinook salmon, above, examination of all water years and averages by WYT indicates that the relative frequency of isolation events under the Proposed Action and Environmental Baseline scenarios are very similar. The frequency of isolation events generally decreases from wetter to drier WYTs under both the Proposed Action and Environmental Baseline scenarios.

Under the Environmental Baseline, fry and juvenile stranding is a stressor of moderate magnitude to steelhead. Because the Proposed Action is anticipated to reduce the potential for stranding and isolation, the Proposed Action is expected to reduce the magnitude of this stressor, the potential "exposure" of steelhead to this stressor, and the effects of this stressor on steelhead critical habitat. Therefore, this stressor is expected to be reduced to a low to moderate magnitude stressor to steelhead in the lower Yuba River under the Proposed Action.

8.3.1.2.2 Water Temperature

Proposed Action compared to the Environmental Baseline

Table 8.3-18 displays the differences in steelhead lifestage-specific WTI value exceedance probabilities under the Proposed Action scenario relative to the Environmental Baseline scenario (i.e., the probability of exceeding a WTI value under the Proposed Action scenario minus the probability of exceeding that WTI value under the Environmental Baseline scenario).

Table 8.3-18. Difference in simulated water temperature exceedance probabilities for steelhead lifestages under the Proposed Action scenario, relative to the Environmental Baseline scenario.

Steelhead Lifestage	Node	Upper Tolerable WTI Value	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Adult Migration	SMRT	68°F	0.0	0.0	0.0	0.0	0.0	0.0									0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Below DPD	68°F	0.0	0.0	0.0	0.0	0.0	0.0									-1.5	-0.3	-1.6	-2.3	0.0	0.0	0.0	0.0	0.0	0.0
	MRY	68°F	0.0	0.0	0.0	0.0	0.0	0.0									0.0	0.0	0.0	0.0	-0.3	0.0	0.0	0.0	0.0	0.0
Adult Holding	SMRT	65°F	0.0	0.0	0.0	0.0	0.0	0.0									0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Below DPD	65°F	0.0	0.0	0.0	0.0	0.0	0.0									0.0	0.0	-0.2	-0.2	-1.0	0.0	0.0	0.0	0.0	0.0
	MRY	65°F	0.0	0.0	0.0	0.0	0.0	0.0									2.8	3.2	2.3	0.3	0.0	0.2	0.0	0.0	0.0	0.0
Spawning	SMRT	57°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																
	Below DPD	57°F	0.0	0.0	0.0	0.0	0.0	-0.2	-0.5	1.5																
Embryo Incubation	SMRT	57°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0														
	Below DPD	57°F	0.0	0.0	0.0	0.0	0.0	-0.2	-0.5	1.5	4.1	2.3														
Juv. Rearing and Downstream Movmt.	Below DPD	68°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	-0.5	-1.4	-1.5	-0.3	-1.6	-2.3	0.0	0.0	0.0	0.0	0.0	0.0
	MRY	68°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.3	0.2	0.0	0.0	0.0	0.0	0.0	-0.3	0.0	0.0	0.0	0.0	0.0
Yearling+ Smolt Emigration	Below DPD	55°F	0.0	0.0	0.0	0.0	0.0	0.3	-1.3												0.2	0.5	-1.6	-0.3	0.0	0.0
	MRY	55°F	0.0	0.0	0.0	0.0	0.0	1.1	0.7												0.0	0.0	-2.0	-1.1	-0.3	0.0

Water temperature exceedance probabilities are generally similar under the Proposed Action and Environmental Baseline scenarios for all lifestages of steelhead. Relatively minor differences (i.e., 4.1 percent or less) in the probability of water temperatures exceeding specified WTIs occur during each lifestage. For all months of the year, no lifestage-specific WTI values are exceeded more often with a 10 percent or greater probability at any of the three evaluated locations under the Proposed Action scenario, relative to the Environmental Baseline scenario.

During the one conference year (WY 1977) in the simulated period of evaluation (WY 1970-2010), water temperature differences between the Proposed Action and the Environmental Baseline scenarios demonstrate similar patterns among the three evaluation locations (Smartsville, Daguerre Point Dam and Marysville). As discussed for spring-run Chinook salmon, water temperatures under the Proposed Action and Environmental Baseline scenarios generally are very similar from October through July at Smartsville and Daguerre Point Dam, and from October through June at Marysville. After those dates, water temperature deviate between the Proposed Action and the Environmental Baseline, with Proposed Action water temperatures becoming increasingly cooler through the remainder of the year. The largest differences occur at Marysville, with water temperatures under the Proposed Action generally 6 to 10°F cooler during September. During this conference year, these cooler water temperatures under the Proposed Action scenario will be more suitable water temperatures during the summer, which includes portions of the steelhead adult migration and holding, and juvenile rearing and downstream movement lifestages.

Overall, under the Environmental Baseline, water temperatures are a low stressor to Yuba River steelhead. Although minor increases and decreases in simulated water temperatures with low probabilities of occurrence are estimated to occur under the Proposed Action relative to the Environmental Baseline, this stressor will remain as a low stressor under the Proposed Action.

8.3.1.2.3 Narrows 2 Operations

Unlike Chinook salmon (potentially including spring-run Chinook salmon), adult steelhead have not been observed proximate to Narrows 2 facilities. Under the Environmental Baseline, Narrows 2 operations were characterized as a low stressor to steelhead. Under the Proposed Action, it is anticipated that Narrows 2 operations would potentially be reduced as a stressor to steelhead, and would continue to be characterized as a low stressor to steelhead.

8.3.1.2.4 Riparian Habitat and Instream Cover (Riparian Vegetation, Instream Woody Material)

As previously discussed for spring-run Chinook salmon, riparian vegetation seedling establishment recession rates are somewhat improved under the Proposed Action relative to the Environmental Baseline. Because spring recession rates of 2.5 cm/day or less are estimated to occur about 89 percent of the time, riparian vegetation recession rates represent a low stressor to steelhead under the Proposed Action.

Under the Environmental Baseline, riparian vegetation and LWM, related primarily to the historical effects of upstream hydraulic mining on the channel geomorphology, and the existence of multiple large dams upstream, provide reduced habitat complexity and diversity, which potentially limits the productivity of juvenile salmonids. The limited availability of riparian habitat and instream cover (in the form of LWM) is a stressor that is manifested every year. Consequently, it was concluded that riparian habitat and instream cover are a stressor of moderate to high magnitude to Yuba River juvenile steelhead. Under the Proposed Action, implementation of YCWA's Proposed Condition AR9 is expected to eventually improve riparian vegetation recruitment by restricting flow reductions during the riparian vegetation seedling establishment period to rates proposed by USFWS/Cal Fish and Wildlife (October 2015) of a stage decrease less than 2.5 cm/day. However, in consideration of the slight improvement to riparian vegetation establishment provided by condition AR9, and in consideration of the timeframe required for riparian vegetation establishment, under the Proposed Action riparian habitat and instream cover would continue to represent a moderate to high stressor to juvenile steelhead.

8.3.1.2.5 Other Stressors

For the remaining stressors besides those that are flow-dependent or water-temperature related and that were previously discussed, the magnitude of the effects of the Proposed Action are expected to be the same as under the Environmental Baseline, as indicated in Table 8.3-19. The Proposed Action is not anticipated to affect the potential "exposure" of steelhead in the lower Yuba River to these stressors, the magnitudes of these stressors, or the effects of these stressors on steelhead critical habitat, relative to the Environmental Baseline.

Table 8.3-19. Non-flow dependent or water temperature stressors and associated magnitudes to steelhead in the lower Yuba River under both the Environmental Baseline and Proposed Action.

Stressor	Relative Magnitude
Passage Impediments/Barriers	
• Englebright Dam	Very High
• Daguerre Point Dam	High
Harvest/Angling	Low
Poaching	Moderate
Hatchery Effects (genetic considerations and straying)	High
Physical Habitat Alteration (Waterway 13 and Lake Wildwood)	Low to Moderate
Fry and Juvenile Rearing Physical Habitat Structure	High
Entrainment	
• BVID diversion	Low
• Hallwood-Cordua and South Yuba/Brophy diversions	Moderate
Predation	Moderate to High
Riparian Habitat and Instream Cover (riparian vegetation, instream woody material)	Moderate to High
Natural River Morphology and Function	High
Floodplain Habitat Availability	High

8.3.1.3 Green Sturgeon

8.3.1.3.1 Adult Holding Habitat

Figure 8.3-13 displays the green sturgeon adult holding habitat exceedance distributions in the Yuba River downstream of Daguerre Point Dam for the Proposed Action and Environmental Baseline scenarios for the February through November potential green sturgeon adult holding, spawning and post-spawning holding period.

Simulated adult green sturgeon holding habitat under the Proposed Action, relative to the Environmental Baseline, is similar over nearly the entire distribution during the February through November period.

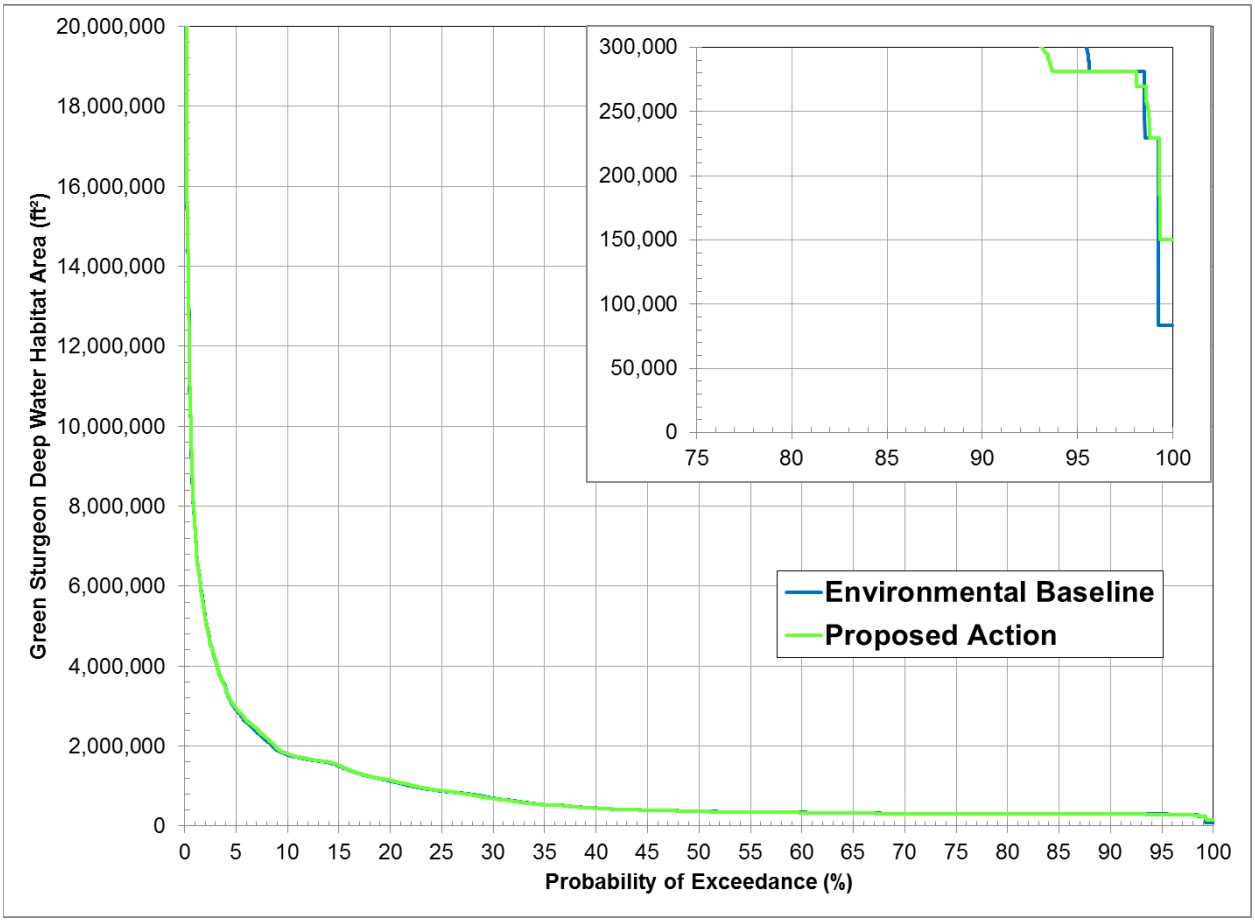

Figure 8.3-13. Simulated adult green sturgeon deepwater holding habitat exceedance during February through November for WY 1970 through 2010 under the Proposed Action and Environmental Baseline scenarios.

8.3.1.3.2 Spawning Habitat

Green sturgeon spawning WUA (within all MUs, and separately for pool MUs) exceedance curves are presented for both the Proposed Action and the Environmental Baseline scenarios for the March through July spawning period for the 41-year simulation period (Figures 8.3-14 and 8.3-15.

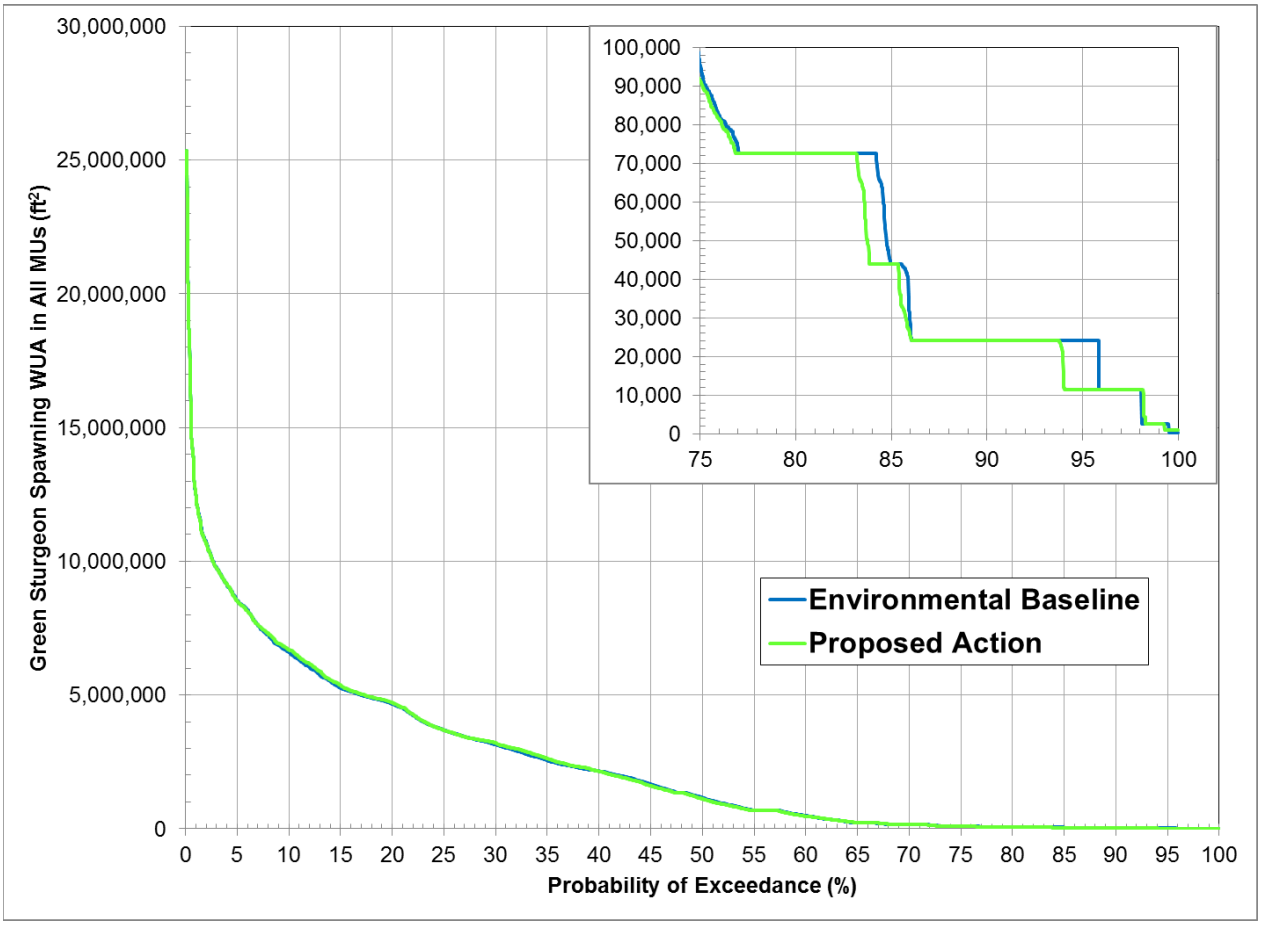

Figure 8.3-14. Simulated green sturgeon spawning WUA (in all morphological units) exceedance during March through June for WY 1970 through 2010 under the Proposed Action and Environmental Baseline scenarios

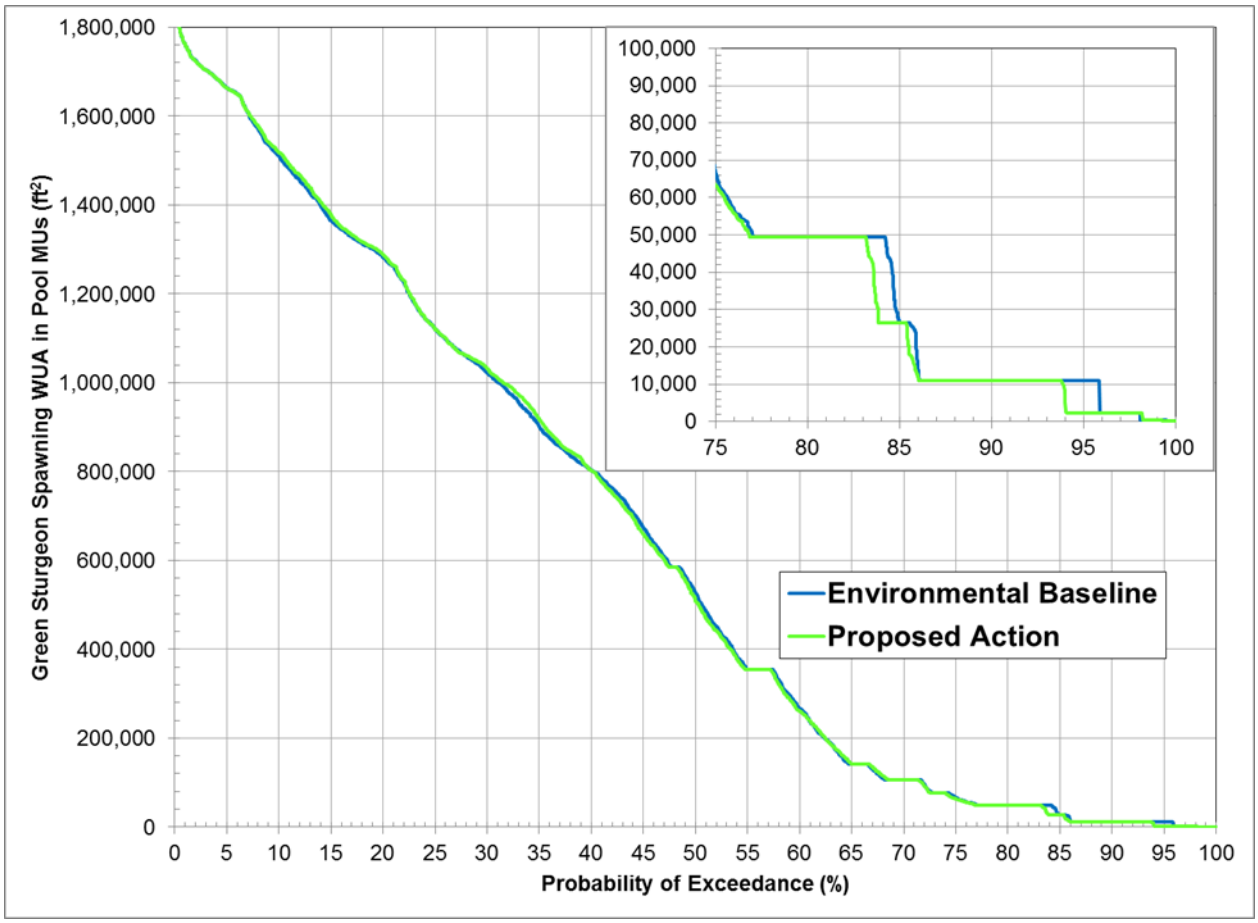

Figure 8.3-15. Simulated green sturgeon spawning WUA (in pool morphological units only) exceedance during March through July for WY 1970 through 2010 under the Proposed Action and Environmental Baseline scenarios.

Simulated adult green sturgeon spawning habitat (WUA) under the Proposed Action scenario is generally similar to the simulated spawning habitat under the Environmental Baseline scenario over nearly the entire distribution during March through July for all MUs, and for only pool MUs below Daguerre Point Dam. As shown in the above figures, the Proposed Action scenario results in very minor reductions in habitat availability over relatively minor portions of the lower quartile of the distribution, relative to the Environmental Baseline scenario.

During the one conference year (WY 1977) in the simulated period of evaluation (WY 1970-2010), for analytical purposes the corresponding green sturgeon holding period extends from February through November of 1977. During that holding season, adult green sturgeon holding habitat was, on average, slightly higher (236,261 ft^2 per day) under the Proposed Action relative to the Environmental Baseline (215,276 ft^2 per day).

During the one conference year (WY 1977), the corresponding green sturgeon spawning period extends from March through July of 1977. Green sturgeon spawning habitat during this spawning season for all MUs is, on average, lower under the Proposed Action scenario (8,360 ft^2

per day) relative to the Environmental Baseline scenario (10,636 ft^2 per day). For pool MUs only, green sturgeon spawning WUA also is lower on average under the Proposed Action scenario (3,620 ft^2 per day) relative to the Environmental Baseline scenario (5,703 ft^2 per day).

Simulated green sturgeon holding habitat and spawning habitat availability is generally similar between the Proposed Action and Environmental Baseline scenarios. Under both scenarios, a substantial amount of deepwater pool habitat and spawning habitat is generally available downstream of Daguerre Point Dam. While there is less spawning habitat available when the analysis is restricted only to pool MUs, the application of the green sturgeon spawning HSCs without restriction to pool MUs likely provides the best available green sturgeon spawning WUA estimate in the Yuba River downstream of Daguerre Point Dam, for the following reasons: 1) the identification of the pool MU was not intended to specifically represent green sturgeon spawning pool habitat; 2) the definition of the pool MU is unduly restrictive regarding application of the green sturgeon spawning HSCs (i.e., particularly the velocity criterion) agreed to by the Relicensing Participants; and 3) the pool MU was identified based on hydraulics, including velocity, at a flow of 530 cfs below Daguerre Point Dam. Further discussion of the appropriateness of applying green sturgeon spawning HSC to pool MUs is provided in Technical Memorandum 7-9, *Green Sturgeon Downstream of Englebright Dam,* which can be found on FERC's eLibrary as referenced by the FERC accession number provided in Table E6-2 of Appendix E6, of YCWA's Amended FLA. Therefore, the simulated estimates of green sturgeon spawning WUA that includes all MUs is expected to better represent potential green sturgeon spawning habitat availability.

8.3.1.3.3 Water Temperatures

The other potential flow-related stressor to green sturgeon in the lower Yuba River is water temperature suitability. The water temperature evaluation for green sturgeon examines the probability of occurrence that water temperatures exceed the upper value of the reported suitable ranges for each of the lifestages with a probability of more than 10 percent.

Proposed Action Compared to the Environmental Baseline

Table 8.3-20 displays the differences in green sturgeon lifestage-specific WTI value exceedance probabilities under the Proposed Action scenario relative to the Environmental Baseline scenario (i.e., the probability of exceeding a WTI value under the Proposed Action scenario minus the probability of exceeding that WTI value under the Environmental Baseline scenario).

Table 8.3-20. Difference in simulated water temperature exceedance probabilities for green sturgeon lifestages under the Proposed Action scenario relative to the Environmental Baseline scenario.

Green Sturgeon Lifestage	Node	Water Temperature Value	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Adult Immigration and Holding	Below DPD	61°F				0.0	0.0	0.0	0.0	0.0																
	MRY	61°F				0.0	0.0	0.0	-1.0	0.0																
Spawning and Embryo Incubation	Below DPD	63°F					0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0										
	MRY	63°F					0.0	0.0	-0.3	0.3	0.2	1.4	2.0	3.1	3.4	3.2										
Post-Spawning Holding	Below DPD	61°F					0.0	0.0	0.0	0.0	0.0	0.5	-0.7	2.1	2.0	1.8	0.8	1.4	2.4	0.7	0.5	0.2	0.0	0.0		
	MRY	61°F					0.0	0.0	-1.0	0.0	1.8	1.7	1.8	1.0	1.6	6.6	4.7	2.6	-1.1	2.6	2.8	0.2	0.0	0.0		
Juv. Rearing and Outmigration	Below DPD	66°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	-1.0	-0.7	0.0	0.0	0.0	0.0	0.0
	MRY	66°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.7	2.0	2.6	2.1	0.5	1.1	0.7	0.2	-0.2	0.0	0.0	0.0	0.0	0.0

Water temperature exceedance probabilities are generally similar under the Proposed Action and Environmental Baseline scenarios during the fall through spring months (i.e., November through April). Under the Proposed Action, water temperatures are slightly higher more often during: 1) late May through July of the spawning and embryo incubation period; 2) May through mid-October for the post-spawning holding lifestage; and June through September of the juvenile rearing and outmigration lifestage. No increases occur in the probability of exceeding the specified WTI at Daguerre Point Dam for the spawning and embryo incubation, or the juvenile rearing and outmigration lifestages. Although slight increases occur at Marysville during late May through July of the spawning and embryo incubation period, these slight increases in the probability of exceeding the 63°F WTI are less than 3.4 percent. Additionally, slight increases occur at Marysville during the June through September portion of the juvenile rearing and outmigration lifestage, although these slight increases in the probability of exceeding the 66°F WTI are less than 2.6 percent. During the May through mid-October portion of the post-spawning holding lifestage, water temperatures exceed the WTI of 61°F with slightly higher probabilities than the other green sturgeon lifestages.

The purpose of evaluation of designated critical habitat is to evaluate changes to the proper function of PBFs. As stated in the critical habitat designation for North American green sturgeon, water temperature-related proper functioning of freshwater habitat includes: 1) stable water temperatures within spawning reaches (wide fluctuations could increase egg mortality or deformities in developing embryos); 2) water temperatures within 51.8-62.6°F (optimal range = 57.2-60.8°F) in spawning reaches for egg incubation (March-August) (Van Eenennaam et al. 2005); 3) water temperatures below 68°F for larval development (Werner et al. 2007 as cited in NMFS 2009b); and 4) water temperatures below 75.2°F for juveniles (Mayfield and Cech 2004; Allen et al. 2006).

There are three additional considerations pertinent to the water temperature suitability evaluations for green sturgeon. First, according to NMFS' designation of North American green sturgeon critical habitat, the proper functioning of freshwater habitat did not even include water temperature for adult holding or post-spawning holding. Second, the infrequent sightings of green sturgeon in the lower Yuba River have occurred immediately downstream of Daguerre Point Dam, and not farther downstream. Third, the use of 61°F as the specified WTI for the pre-

and post-spawning holding lifestages may be overly rigorous, considering that the spawning WTI itself was established as 63°F.

Simulated water temperatures are slightly lower more often under the Proposed Action scenario during early April for most lifestages, and during late September and early October at Daguerre Point Dam for the juvenile rearing and outmigration lifestage, relative to the Environmental Baseline scenario. Simulated water temperatures under the Proposed Action scenario do not exceed lifestage-specific WTI values more often than the Environmental Baseline scenario with a 10 percent or greater probability of occurrence during any month of the year for any lifestage.

During the one conference year (WY 1977) in the simulated period of evaluation (WY 1970-2010), simulated water temperature differences between the Proposed Action and the Environmental Baseline scenarios demonstrate similar patterns among the evaluation locations (Daguerre Point Dam and Marysville). Simulated water temperatures under the Proposed Action and Environmental Baseline scenarios are generally similar during most times of the year, but are notably cooler during July through September under the Proposed Action at the Daguerre Point Dam and Marysville locations. For this one conference year, these cooler water temperatures under the Proposed Action scenario would be more suitable during the summer, which includes portions of the green sturgeon spawning, post-spawning holding, and juvenile rearing and outmigration lifestages.

Overall, although relatively minor increases in WTI value exceedances are estimated to occur under the Proposed Action scenario relative to the Environmental Baseline scenario, the above considerations indicate that these increases are insignificant.

8.4 Cumulative Effects

Cumulative effects are defined by federal regulations as "*…those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation*" (50 C.F.R. §402.02). Cumulative effects must be considered in the analysis of the effects of the Proposed Action (50 C.F.R. §402.12(f)(4)).

The cumulative effects assessment in this Applicant-Prepared Draft BA quantitatively addresses changes in lower Yuba River flows and water temperatures that may result from implementation of the Proposed Action, in addition to changes in operations of projects in the upper Yuba River Basin upstream of Englebright Dam, and increased diversions associated with implementation of the Yuba-Wheatland In-Lieu Groundwater Recharge and Storage Project (Wheatland Project).

As previously discussed (Section 7.0), modeling of projects in the upper Yuba River Basin upstream of Englebright Dam was available for the period extending from WY 1976 through 2008, and therefore cumulative effects were evaluated by comparing hydrologic and water temperature simulations for that period. Otherwise, the same methodologies that were used to evaluate potential effects to listed species and their critical habitat in the lower Yuba River from the Enviornmental Baseline relative to the Without-Project scenario, and the Proposed Action

relative to the Environmental Baseline were utilized to assess potential effects associated with the Cumulative Condition, relative to the Environmental Baseline.

In addition to these quantitative hydrologic and water temperature evaluations, for each stressor to listed species that was identified under the Environmental Baseline discussion, an evaluation is presented here, discussing whether the Cumulative Condition will affect that stressor, whether that effect is beneficial or adverse, and the resultant magnitude of effect of each stressor. These evaluations are followed by identifications of other future non-federal activities that are reasonably certain to occur in the Action Area, with particular reference to the lower Yuba River. Identified activities are evaluated as to whether they have the potential to affect listed species or their critical habitat, including any effects related to instream flows and water temperatures.

As demonstrated in Section 4.0 of this Applicant-Prepared Draft BA, analyses were undertaken to confirm the downstream extent of the Action Area as the lower Yuba River confluence with the Feather River. However, areas downstream of the lower Yuba River (i.e., lower Feather River, lower Sacramento River, and the Bay-Delta) are considered within the context of cumulative effects.

8.4.1 Spring-run Chinook Salmon

8.4.1.1 Flow-Dependent Habitat Conditions

8.4.1.1.1 Spawning Habitat Availability

Because flows do not exceed 5,000 cfs during the September through mid-October spring-run Chinook salmon spawning period under the Cumulative Condition and Environmental Baseline scenarios, no daily flows were excluded from the spring-run Chinook salmon spawning WUA analysis. Table 8.4-1 displays the long-term average and average by WYT spring-run Chinook salmon spawning WUA (percent of maximum) under the Cumulative Condition and Environmental Baseline.

Table 8.4-1. Long-term and water year type average spring-run Chinook salmon spawning WUA (percent of maximum) under the Cumulative Condition and Environmental Baseline scenarios.

Scenario	Long-term Full Simulation Period[2]	WYTs[1]				
		Wet	Above Normal	Below Normal	Dry	Critical
Cumulative Condition	99.2	99.0	99.1	99.6	99.7	99.0
Environmental Baseline	98.6	99.3	99.4	99.6	99.6	95.9
Difference	0.6	-0.3	-0.3	0.0	0.1	3.1

[1] As defined by the Yuba River Index (YRI) WY Hydrologic Classification.
[2] Based on the WY 1976-2008 simulation period.

Over the entire 33-year simulation period, long-term average spring-run Chinook salmon in-channel spawning habitat availability (WUA) in the lower Yuba River is similar, but slightly

higher, under the Cumulative Condition scenario relative to the Environmental Baseline scenario (long-term average of 99.2 percent versus 98.6 percent of the maximum WUA). The Cumulative Condition scenario provides similarspawning habitat availability (percent of maximum WUA) during all WYTs, with the exception of critical WYs, when the Cumulative Condition scenario provides 3.1 percent more spawning habitat. As with the Environmental Baseline scenario, the Cumulative Condition scenario provides, on the average, 80 percent (and even 90 percent) or more of maximum spawning WUA during all WYTs.

Habitat durations for spring-run Chinook salmon spawning under the Cumulative Condition and Environmental Baseline scenarios are presented in Figure 8.4-1.

The Cumulative Condition scenario provides similar amounts of in-channel spawning habitat availability over nearly the entire exceedance probability distribution, relative to the Environmental Baseline scenario. Also, the Cumulative Condition achieves over 80 percent (and even 90 percent) of spawning maximum WUA with about a 100 percent probability, while the Environmental Baseline scenarioachieves 80 percent (and even 95 percent) or more of spawning maximum WUA with about an 98 percent probability.

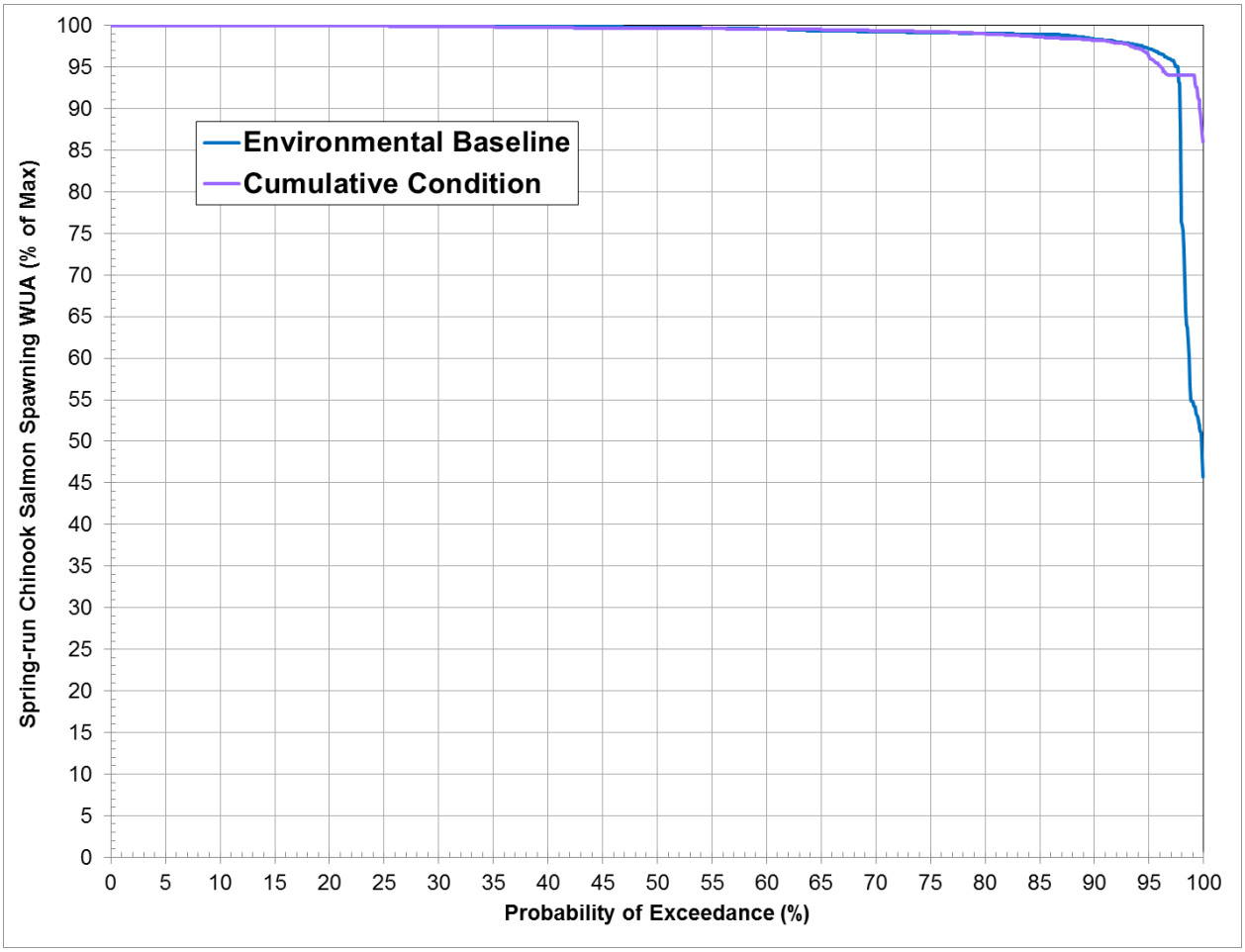

Figure 8.4-1. Spring-run Chinook salmon spawning habitat duration over the 33-year hydrologic period for the Cumulative Condition and Environmental Baseline scenarios.

During the one conference year (WY 1977) in the simulated period of evaluation (WY 1976-2008), for analytical purposes the corresponding spring-run Chinook salmon spawning period extends from September 1 – October 15 of 1977. During that spawning season, 94.3 percent of spring-run Chinook salmon maximum spawning WUA was provided under the Cumulative Condition scenario, compared to 71.5 percent provided under the Environmental Baseline scenario.

Flow-dependent spawning habitat availability under the Cumulative Condition is similar to, or slightly greater than that under the Environmental Baseline. Flow-dependent spawning habitat availability remains characterized as a low stressor under the Cumulative Condition.

8.4.1.1.2 Potential Redd Dewatering

For every day of the annual embryo incubation period, the long-term annual average of the percentage of spring-run Chinook salmon redds potentially dewatered under the Cumulative Condition scenario is very low, and similar to that under the Environmental Baseline scenario. The average percentage of redds potentially dewatered by WYTs under the Cumulative Condition would be very low and similar to that under the Environmental Baseline scenario (Table 8.4-2).

Table 8.4-2. Estimated spring-run Chinook salmon redd and egg pocket potential dewatering under the Cumulative Condition relative to the Environmental Baseline.

WYT Categories	Redd Dewatering Index (%)			Egg Pocket Dewatering Index (%)		
	Cumulative Condition	Environmental Baseline	Difference	Cumulative Condition	Environmental Baseline	Difference
Long-term (All WYs)	0.03%	0.01%	0.02%	0.00%	0.00%	0.00%
Wet	0.06%	0.02%	0.04%	0.00%	0.00%	0.00%
Above Normal	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%
Below Normal	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Dry	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Critical	0.01%	0.00%	0.01%	0.00%	0.00%	0.00%

The long-term and WYT averages of the percentage of egg pockets dewatered indicates that no egg pockets would be dewatered under the Cumulative Condition scenario or the Environmental Baseline scenario.

During the one conference year (WY 1977) in the simulated period of evaluation (WY 1976-2008), no spring-run Chinook salmon redds or egg pockets would potentially be dewatered under the Cumulative Condition scenario or under the Environmental Baseline scenario.

As previously discussed, Proposed Condition AR9, Control Project Ramping and Flow Fluctuation Downstream of Englebright Dam, was developed in part to minimize the potential for spring-run Chinook salmon redd dewatering during the period from September 2 through December 31 (corresponding to the spring-run Chinook salmon spawning and incubation period).

Proposed Condition AR9 would not necessarily apply to every day each year of the embryo incubation period. During the days over the 33-year period of evaluation when this proposed condition would apply, it would provide the intended protection for spring-run Chinook salmon redd dewatering (Table 8.4-3). The estimated spring-run Chinook salmon potential dewatering under the Cumulative Condition would be very similar as under the Proposed Action, because during the embryo incubation period flows are almost always controlled.

Table 8.4-3. Estimated spring-run Chinook salmon redd and egg pocket potential dewatering under the Cumulative Conditon relative to the Environmental Baseline for those days in th e33-year period of record during which the flow reduction criteria specified in Proposed Condition AR9 would apply.

WYT Categories	Redd Dewatering Index (%)			Egg Pocket Dewatering Index (%)		
	Cumulative Condition	Environmental Baseline	Difference	Cumulative Condition	Environmental Baseline	Difference
Long-term (All WYs)	0.03%	0.01%	0.02%	0.00%	0.00%	0.00%
Wet	0.06%	0.01%	0.05%	0.00%	0.00%	0.00%
Above Normal	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%
Below Normal	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Dry	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Critical	0.01%	0.00%	0.01%	0.00%	0.00%	0.00%

Spring-run Chinook salmon redd dewatering under the Cumulative Condition is estimated to be very low and similar to that under the Environmental Baseline. Potential redd dewatering would be a low stressor to spring-run Chinook salmon under the Cumulative Condition.

8.4.1.1.3 Fry and Juvenile Rearing Habitat Availability

Spring-run Chinook Salmon Fry Rearing In-Channel Habitat

During the mid-November through mid-February spring-run Chinook salmon fry rearing period, flows exceed 5,000 cfs during about 12 percent of the days over the 33-year simulation period for the Cumulative Condition and the Environmental Baseline. These days were excluded from the spring-run Chinook salmon fry in-channel rearing WUA analysis. Table 8.4-4 displays the long-term average and average by WYT spring-run Chinook salmon fry in-channel rearing WUA (percent of maximum) under the Cumulative Condition and Environmental Baseline scenarios.

Table 8.4-4. Long-term and WYT average spring-run Chinook salmon fry in-channel rearing WUA (percent of maximum) under the Cumulative Condition and Environmental Baseline scenarios.

Scenario	Long-term Full Simulation Period[2]	WYTs[1]				
		Wet	Above Normal	Below Normal	Dry	Critical
Cumulative Condition	88.4	88.4	88.9	86.7	87.5	89.6
Environmental Baseline	88.6	88.6	88.8	87.0	88.2	89.7
Difference	-0.2	-0.2	0.1	-0.3	-0.7	-0.1

[1] As defined by the Yuba River Index (YRI) WY Hydrologic Classification.
[2] Based on the WY 1976-2008 simulation period.

Over the entire 33-year simulation period, long-term average fry rearing habitat availability (WUA) in the lower Yuba River is very similar under the Cumulative Condition and Environmental Baseline scenarios (long-term average of 88.4 percent and 88.6 percent of the maximum WUA). The Cumulative Condition and Environmental Baseline scenarios also result in similar amounts of WUA by WYT. Both the Cumulative Condition and Environmental Baseline scenarios provide an average of 80 percent or more fry in-channel rearing maximum WUA during all WYTs.

Habitat duration for spring-run Chinook salmon fry in-channel rearing under the Cumulative Condition and Environmental Baseline scenarios is presented in Figure 8.4-2. The Cumulative Condition and Environmental Baseline scenarios provide similar amounts of habitat over the entire distribution, but the Cumulative Condition provides slightly more habitat over about the lower 5 percent of the distribution, and provides slightly less habitat over about 20 percent of the distribution. The Cumulative Condition and Environmental Baseline scenarios both achieve 80 percent or more of fry in-channel rearing maximum WUA with 100 percent probability.

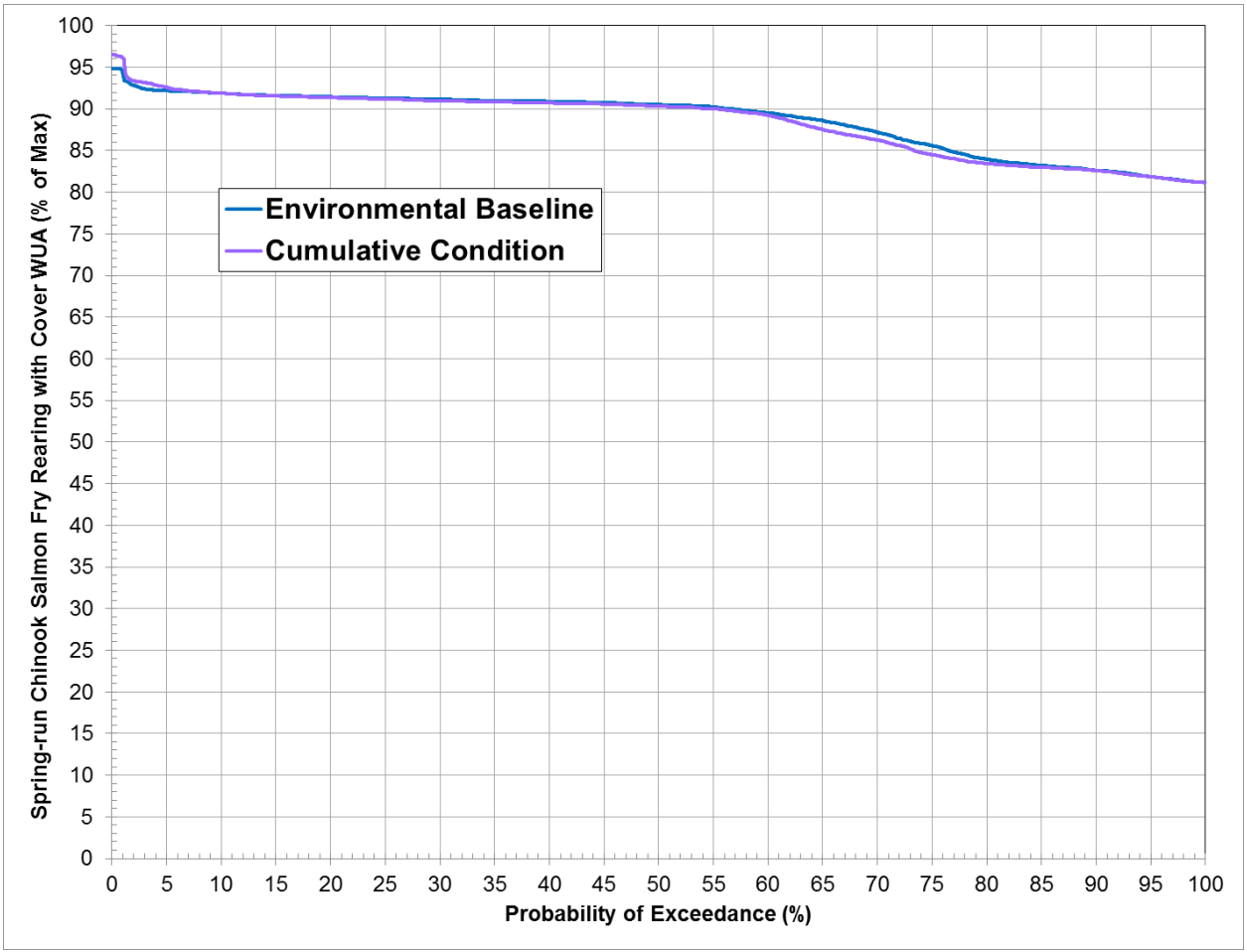

Figure 8.4-2. Spring-run Chinook salmon fry in-channel rearing habitat duration over the 33-year hydrologic period for the Cumulative Condition and Environmental Baseline scenarios.

During the one conference year (WY 1977) in the simulated period of evaluation (WY 1976-2008), 92.5 percent of spring-run Chinook salmon fry in-channel rearing maximum WUA was provided under the Cumulative Condition scenario compared to 91.2 percent provided under the Environmental Baseline scenario.

Spring-run Chinook Salmon Fry Rearing Full-Flow Habitat

Table 8.4-5 displays the full-flow analysis of the average amounts (ac) of spring-run Chinook salmon fry WUA without cover under the Cumulative Condition and the Environmental Baseline over the 33-year period of evaluation. Results are shown for all days, for days when flows were less than or equal to 5,000 cfs and for days when flows were greater than 5,000 cfs, and the differences between the two scenarios over the long-term full simulation period (all years) and by WYT.

For the entire simulation period, very similar amounts of fry rearing habitat (average WUA) are available under the Cumulative Condition compared to the Environmental Baseline, as well as for each of the WYTs.

Table 8.4-5. Long-term average WUA (ac) over the 33-year period of evaluation and WYT-specific relative contribution to the long-term average WUA of spring-run Chinook salmon fry rearing habitat, under the Cumulative Condition and the Environmental Baseline.

Scenario	Long-term Full Simulation Period[2]	WYTs[1]				
		Wet	Above Normal	Below Normal	Dry	Critical
Cumulative Condition						
Total Days in Analysis	**3,036**	**1,012**	**460**	**368**	**460**	**736**
Days ≤ 5,000 cfs	2,656	665	436	363	457	735
Days > 5,000 cfs	380	347	24	5	3	1
Avg. WUA	**153.8**	**53.2**	**23.0**	**17.7**	**22.5**	**37.5**
WUA ≤ 5,000 cfs	130.8	32.1	21.5	17.4	22.3	37.5
WUA > 5,000 cfs	23.1	21.1	1.5	0.3	0.2	0.1
Environmental Baseline						
Total Days in Analysis	**3,036**	**1,012**	**460**	**368**	**460**	**736**
Days ≤ 5,000 cfs	2,677	682	438	364	458	735
Days > 5,000 cfs	359	330	22	4	2	1
Avg. WUA	**154.4**	**53.3**	**23.0**	**17.8**	**22.8**	**37.6**
WUA ≤ 5,000 cfs	132.4	33.0	21.6	17.6	22.7	37.6
WUA > 5,000 cfs	22.0	20.3	1.4	0.2	0.1	0.1
Differences						
Avg. WUA	**-0.6**	**-0.1**	**0.0**	**-0.1**	**-0.3**	**-0.1**
% change	**-0.4%**	**-0.1%**	**0.0%**	**-0.6%**	**-1.4%**	**-0.3%**

[1] As defined by the Yuba River Index (YRI) WY Hydrologic Classification.
[2] Based on the WY 1970-2010 simulation period.

Figure 8.4-3 displays the full-flow analysis of the average amounts (ac) of spring-run Chinook salmon fry WUA without cover under the Cumulative Condition and the Environmental Baseline. For both scenarios, a trend was observed of the most spring-run Chinook salmon fry habitat occurring during wet WYs with decreasing amounts from wet to below normal WYTs, then fry habitat increasing for dry and critical WYs. For both the Cumulative Condition and Environmental Baseline scenarios, relatively little to no additional fry rearing habitat is provided by days when flows were > 5,000 cfs for below normal, dry, and critical WYTs.

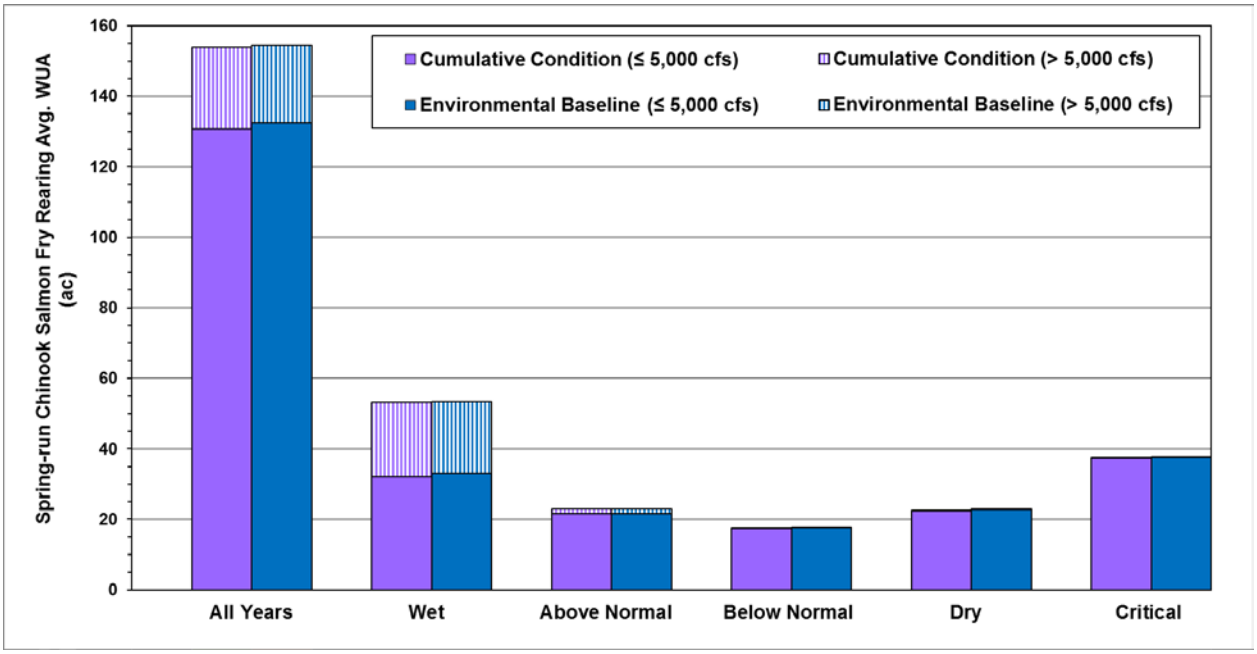

Figure 8.4-3. Comparison of the average amount (ac) of spring-run Chinook salmon fry weighted usable area (WUA) without cover under the Cumulative Condition and the Environmental Baseline scenarios over the 33-year period of evaluation. Shown are the amounts over the long-term full simulation period (all years) and by water year type of habitat provided on days when flows were ≤ 5,000 cfs and for days when flows were > 5,000 cfs.

Spring-run Chinook Salmon Juvenile Rearing In-Channel Habitat

During the year-round spring-run Chinook salmon juvenile rearing period, flows exceed 5,000 cfs during about 11 percent of the days over the 33-year simulation period for the Cumulative Condition and Environmental Baseline scenarios. These days were excluded from the spring-run Chinook salmon juvenile in-channel rearing WUA analysis. Table 8.4-6 displays the long-term average and average by WYT spring-run Chinook salmon juvenile in-channel rearing WUA (percent of maximum) under the Cumulative Condition and Environmental Baseline scenarios.

Table 8.4-6. Long-term and WYT average spring-run Chinook salmon juvenile in-channel rearing WUA (percent of maximum) under the Cumulative Condition and Environmental Baseline scenarios.

Scenario	Long-term Full Simulation Period[2]	WYTs[1]				
		Wet	Above Normal	Below Normal	Dry	Critical
Cumulative Condition	96.4	95.4	95.6	96.2	97.2	97.5
Environmental Baseline	96.5	95.5	95.8	96.4	97.5	97.1
Difference	-0.1	-0.1	-0.2	-0.2	-0.3	0.4

[1] As defined by the Yuba River Index (YRI) WY Hydrologic Classification.
[2] Based on the WY 1976-2008 simulation period.

Over the entire 33-year simulation period, long-term average juvenile in-channel rearing habitat availability (WUA) in the lower Yuba River is very similar under the Cumulative Condition and Environmental Baseline scenarios (long-term average of 96.4 percent and 96.5 percent of the maximum WUA, respectively). The Cumulative Condition and Environmental Baseline scenarios also result in similar amounts of WUA by WYT. Both the Cumulative Condition and Environmental Baseline scenarios provide an average of 80 percent (and even over 95 percent) or more of maximum juvenile rearing WUA during all WYTs.

Habitat durations for spring-run Chinook salmon juvenile rearing under the Cumulative Condition and Environmental Baseline scenarios are presented in Figure 8.4-4. The Cumulative Condition and Environmental Baseline scenarios provide similar amounts of habitat over the entire distribution, but the Cumulative Condition scenario does provide more habitat over about the lower 1 percent of the distribution when juvenile rearing is most limited. The Cumulative Condition and Environmental Baseline scenarios both achieve 80 percent (and even 90 percent) or more of juvenile in-channel rearing maximum WUA with about a 99 percent probability.

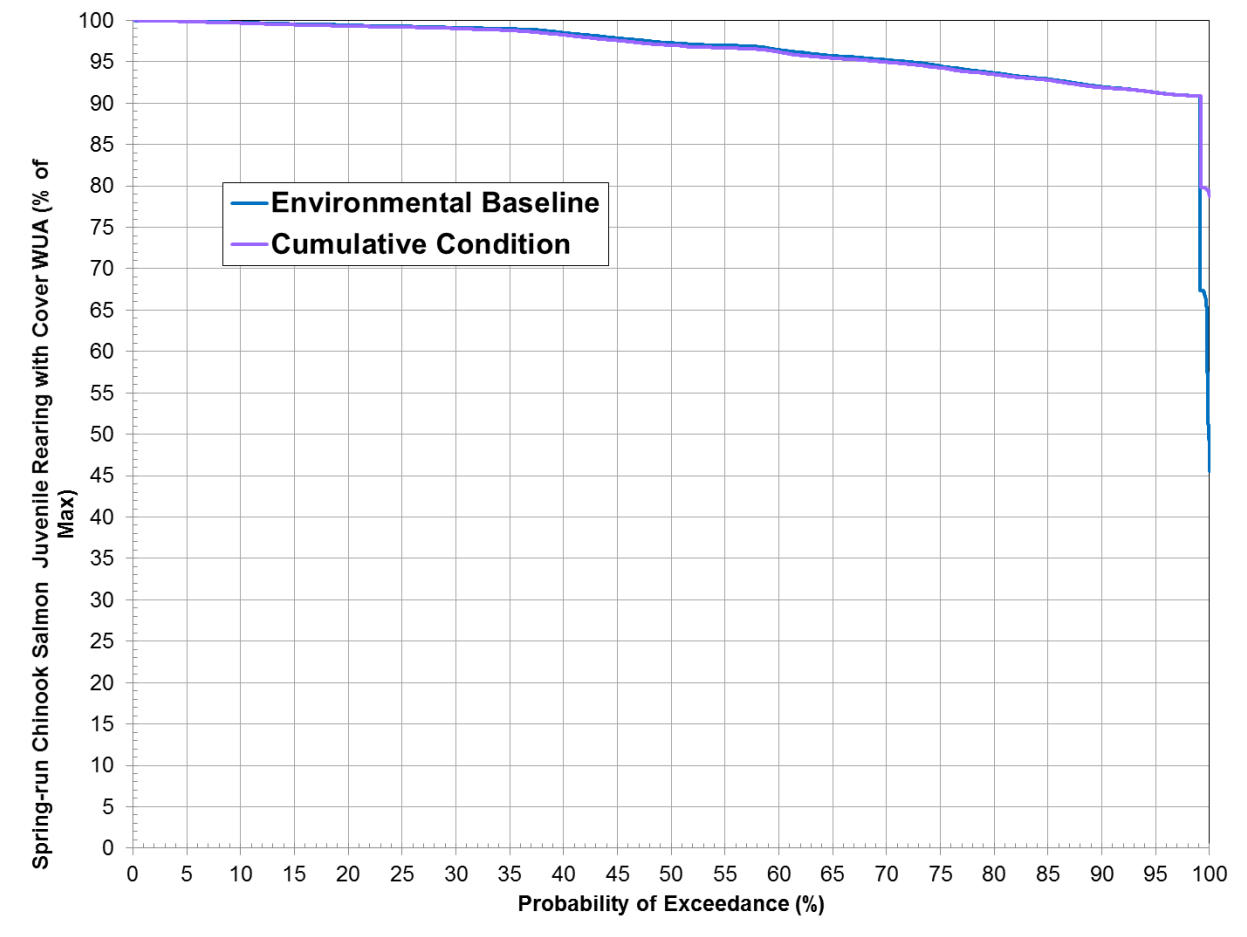

Figure 8.4-4. Spring-run Chinook salmon juvenile in-channel rearing habitat duration over the 33-year hydrologic period for the Cumulative Condition and Environmental Baseline scenarios.

During the one conference year (WY 1977) in the simulated period of evaluation (WY 1976-2008), 93.7 percent of spring-run Chinook salmon maximum juvenile in-channel rearing WUA was provided under the Cumulative Condition scenario compared to 89.0 percent provided under the Environmental Baseline scenario.

Spring-run Chinook Salmon Juvenile Rearing Full-Flow Habitat

Table 8.4-7 displays the full-flow analysis of the average amounts (ac) of spring-run Chinook salmon juvenile WUA without cover under the Cumulative Condition and the Environmental Baseline over the 33-year period of evaluation. For the entire simulation period and by WYT, very similar amounts of juvenile rearing habitat (average WUA) are available under the Cumulative Condition and the Environmental Baseline.

Table 8.4-7. Long-term average WUA (ac) over the 33-year period of evaluation and WYT-specific relative contribution to the long-term average WUA of spring-run Chinook salmon juvenile rearing habitat, under the Cumulative Condition and the Environmental Baseline.

Scenario	Long-term Full Simulation Period[2]	WYTs[1]				
		Wet	Above Normal	Below Normal	Dry	Critical
Cumulative Condition						
Total Days in Analysis	**12,053**	**4,017**	**1,826**	**1,461**	**1,826**	**2,923**
Days ≤ 5,000 cfs	10,766	2,936	1,687	1,403	1,821	2,919
Days > 5,000 cfs	1,287	1,081	139	58	5	4
Avg. WUA	**254.3**	**84.7**	**37.1**	**30.2**	**38.8**	**63.4**
WUA ≤ 5,000 cfs	223.9	58.9	34.0	29.0	38.7	63.4
WUA > 5,000 cfs	30.4	25.8	3.1	1.3	0.1	0.1
Environmental Baseline						
Total Days in Analysis	**12,053**	**4,017**	**1,826**	**1,461**	**1,826**	**2,923**
Days ≤ 5,000 cfs	10,776	2,952	1,679	1,403	1,823	2,919
Days > 5,000 cfs	1,277	1,065	147	58	3	4
Avg. WUA	**254.8**	**85.0**	**37.2**	**30.4**	**39.1**	**63.2**
WUA ≤ 5,000 cfs	224.5	59.3	34.0	29.1	39.0	63.1
WUA > 5,000 cfs	30.3	25.6	3.2	1.3	0.1	0.1
Differences						
Avg. WUA	**-0.6**	**-0.2**	**-0.1**	**-0.1**	**-0.3**	**0.2**
% change	**-0.2%**	**-0.3%**	**-0.3%**	**-0.4%**	**-0.7%**	**0.3%**

[1] As defined by the Yuba River Index (YRI) WY Hydrologic Classification.
[2] Based on the WY 1970-2010 simulation period.

Figure 8.4-5 displays the full-flow analysis of the average amounts (ac) of spring-run Chinook salmon juvenile WUA without cover under the Cumulative Condition and the Environmental Baseline scenarios. For both scenarios, decreasing amounts of total habitat were provided from wet to below normal WYTs, then increasing amounts were provided for dry and critical WYTs. For both the Cumulative Condition and Environmental Baseline, relatively little to no additional juvenile rearing habitat is provided by days when flows were > 5,000 cfs for below normal, dry and critical WYTs.

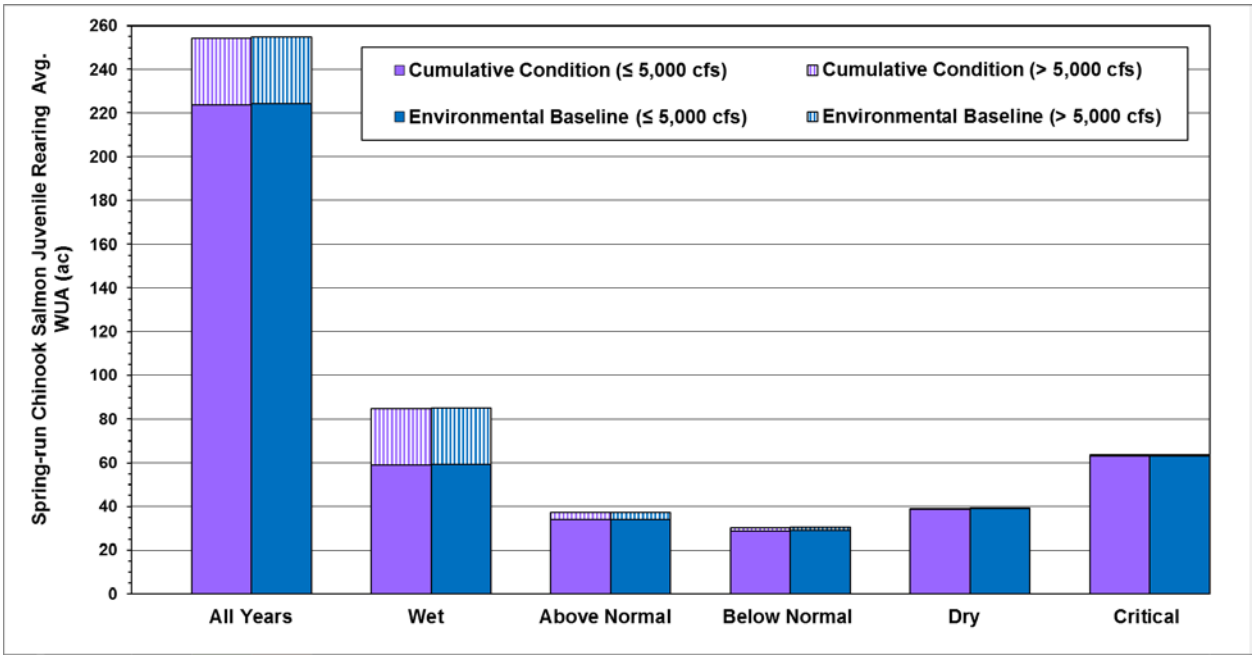

Figure 8.4-5. Comparison of the average amount (ac) of spring-run Chinook salmon juvenile weighted usable area (WUA) without cover under the Cumulative Condition and the Environmental Baseline over the 33-year period of evaluation. Shown are the amounts over the long-term full simulation period (all years) and by water year type of habitat provided on days when flows were ≤ 5,000 cfs and for days when flows were > 5,000 cfs.

Fry and Juvenile Rearing Habitat as Stressors

Spring-run Chinook salmon flow-dependent fry and juvenile rearing habitat availability under the Cumulative Condition is similar to that under the Environmental Baseline. Flow-dependent fry and juvenile rearing habitat availability under the Cumulative Condition represents a low stressor to spring-run Chinook salmon.

As a stressor, flow-dependent rearing habitat availability is distinct from rearing habitat physical structure. Aquatic habitat complexity and diversity is limited in the lower Yuba River. Restricted availability of complex, diverse habitats such as multiple braided channels and side channels associated with the loss of natural river morphology and function continues to be a high stressor to rearing juvenile anadromous salmonids. Fry and juvenile rearing physical habitat structure under the Environmental Baseline is a high stressor to Yuba River spring-run Chinook salmon. Although separate initiatives (by the AFRP and the Corps) are presently contemplating and evaluating habitat improvement measures in the lower Yuba River, they are not sufficiently advanced at this time to represent reasonably foreseeable actions within the context of this Applicant-Prepared Draft BA. These and potentially similar initiatives may reduce the severity of fry and juvenile rearing physical habitat structure as a stressor eventually if they are implemented, but it remains a high stressor under the Cumulative Condition.

8.4.1.1.4 Fry and Juvenile Stranding and Isolation

The proposed lower maximum authorized ramping rate under the Proposed Action also is anticipated to reduce the potential for juvenile isolation in the lower Yuba River under the Cumulative Condition, relative to the Environmental Baseline. The lower maximum authorized ramping rate may better allow juvenile salmonids to volitionally move out of off-channel areas.

Figure 8.4-6 displays the annual average number of off-channel areas (as a percentage of the total number of off-channel areas) that experience *n* isolation events in the entire lower Yuba River for the Cumulative Condition and Environmental Baseline scenarios for all water years combined, and separately for wet, above normal, below normal, dry and critical WYs. Examination of all water years and averages by WYT indicates that the relative frequency of isolation events under the Cumulative Condition and Environmental Baseline scenarios are very similar. The frequency of isolation events generally decreases from wetter to drier WYTs under both the Cumulative Condition and Environmental Baseline scenarios. As discussed for the Proposed Action, the new flow fluctuation criteria under the Proposed Action (and under the Cumulative Condition) is anticipated to reduce the potential for juveniles to be isolated.

During the one conference year (WY 1977) in the simulated period of evaluation (WY 1976-2008), the frequency of isolation events are very similar under the Cumulative Condition and Environmental Baseline scenarios.

Under the Environmental Baseline, fry and juvenile stranding and isolation is a stressor of moderate magnitude to spring-run Chinook salmon. Because the Cumulative Condition is anticipated to reduce the potential for stranding and isolation, the Cumulative Condition is expected to reduce the magnitude of this stressor, the potential "exposure" of spring-run Chinook salmon to this stressor, and the effects of this stressor on spring-run Chinook salmon critical habitat. Therefore, this stressor is expected to be reduced to a low to moderate magnitude stressor to spring-run Chinook salmon in the lower Yuba River under the Cumulative Condition.

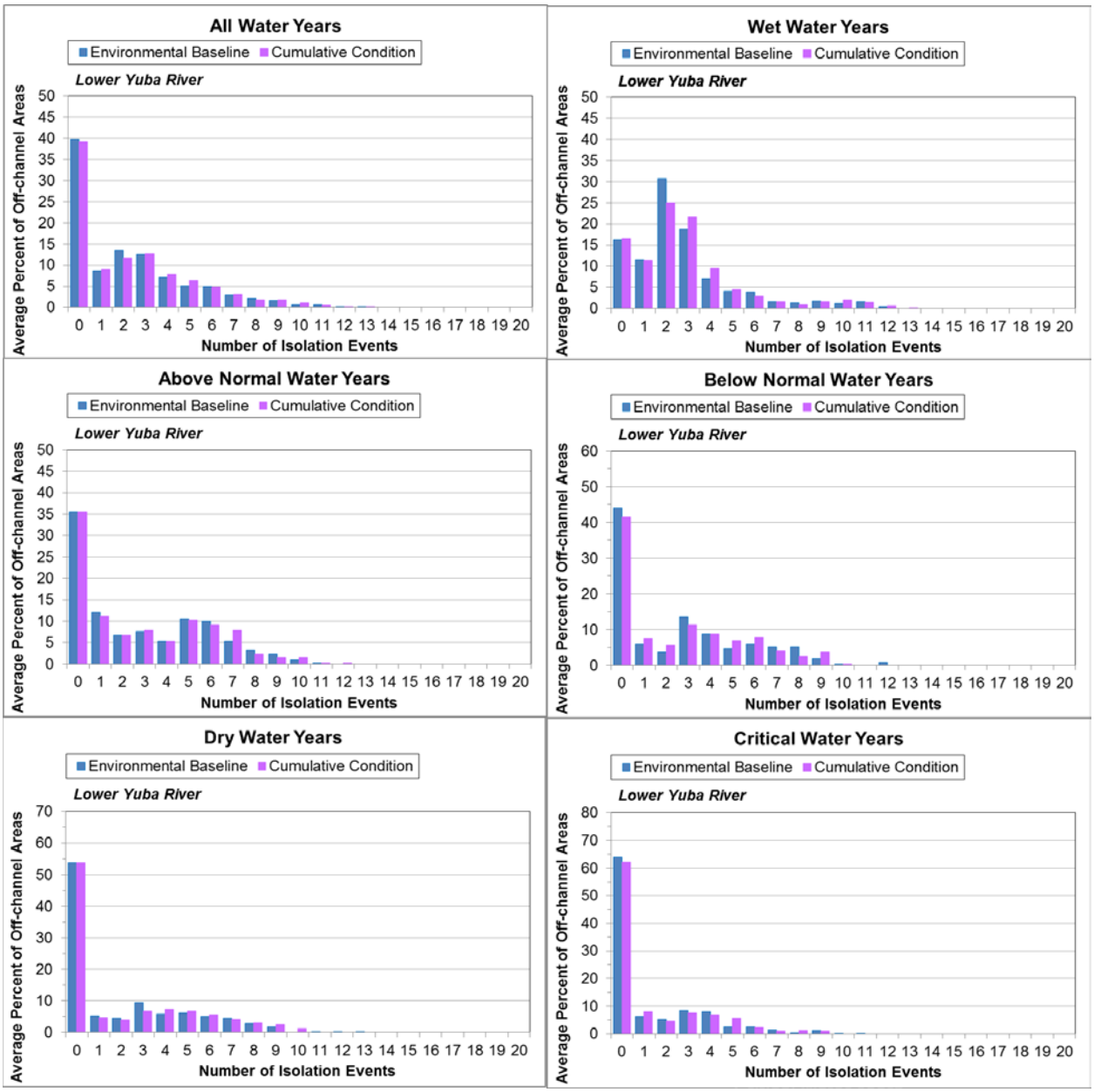

Figure 8.4-6. Frequency of off-channel area isolation events over the 33-year hydrologic period for the Cumulative Condition and Environmental Baseline scenarios.

8.4.1.2 Water Temperature

8.4.1.2.1 Cumulative Condition Compared to the Environmental Baseline

Table 8.4-8 displays the differences in spring-run Chinook salmon lifestage-specific WTI value exceedance probabilities under the Cumulative Condition scenario relative to the Environmental Baseline scenario (i.e., the probability of exceeding a WTI value under the Cumulative Condition scenario minus the probability of exceeding that WTI value under the Environmental Baseline scenario).

Table 8.4-8. Difference in simulated water temperature exceedance probabilities for spring-run Chinook salmon lifestages under the Cumulative Condition scenario relative to the Environmental Baseline scenario.

Spring-run Chinook Salmon Lifestage	Node	Upper Tolerable WTI Value	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Adult Immigration	SMRT	68°F							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
	Below DPD	68°F							0.0	0.0	0.0	0.0	0.0	-0.4	-0.8	-2.5	-2.0	-0.9	-2.4	-2.8						
	MRY	68°F							0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0						
Adult Holding	SMRT	65°F							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
	Below DPD	65°F							0.0	0.0	0.0	0.0	0.8	0.2	0.0	0.0	0.0	0.0	-0.2	-0.4						
	MRY	65°F							0.0	0.0	0.0	0.0	-0.6	0.8	2.4	4.9	3.0	3.0	3.4	1.6						
Spawning	SMRT	58°F																	0.0	0.0	0.0					
Embryo Incubation	SMRT	58°F																	0.0	0.0	0.0	-0.8	-1.4	0.0	0.0	0.0
Juv. Rearing and Downstream Movmt.	Below DPD	65°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.2	0.0	0.0	0.0	0.0	-0.2	-0.4	-1.6	0.0	0.0	0.0	0.0	0.0
	MRY	65°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.6	0.8	2.4	4.9	3.0	3.0	3.4	1.6	-0.2	-0.4	0.0	0.0	0.0	0.0
Yearling+ Smolt Emigration	Below DPD	68°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0										0.0	0.0	0.0	0.0	0.0	0.0
	MRY	68°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0										-1.0	0.0	0.0	0.0	0.0	0.0

Water temperature exceedance probabilities are generally similar under the Cumulative Condition and Environmental Baseline scenarios most of the time for all lifestages of spring-run Chinook salmon. Some differences in simulated water temperatures primarily occur during the spring-run Chinook salmon adult holding, and juvenile rearing and downstream movement lifestages. For all months of the year, no lifestage-specific WTI values are exceeded more often with a 10 percent or greater probability at any of the three evaluated locations under the Cumulative Condition scenario, relative to the Environmental Baseline scenario.

During the adult holding period, water temperatures at the Marysville location are slightly higher during July through September under the Cumulative Condition scenario compared to the Environmental Baseline scenario. However, as previously discussed, adult spring-run Chinook salmon do not spend extended periods of time at downstream locations (e.g., Marysville), and they primarily exhibit holding behavior just downstream of Daguerre Point Dam or in areas above Daguerre Point Dam.

During the juvenile rearing and downstream movement lifestage, which extends year-round, water temperatures at the Marysville location are slightly higher under the Cumulative Condition scenario compared to the Environmental Baseline scenario during late June through September. However, exposure of downstream migrating juveniles during summer months to water temperatures at Marysville would not be expected to substantially occur due to minimal

outmigration during the summer, and the suitability of rearing temperatures further upstream in this reach below Daguerre Point Dam.

During the one conference year (WY 1977) in the simulated period of evaluation (WY 1970-2010), water temperature differences between the Cumulative Condition and the Environmental Baseline scenarios demonstrate similar patterns among the three evaluation locations (Smartsville, Daguerre Point Dam and Marysville). Relative to the Environmental Baseline, generally similar or slightly cooler water temperatures occur under the Cumulative Condition from October through July at Smartsville and Daguerre Point Dam, and from October through June at Marysville. After those dates, water temperatures deviate between the Cumulative Condition and the Environmental Baseline, with Cumulative Condition water temperatures becoming increasingly cooler through the remainder of the year. The largest differences occur at Marysville, with water temperatures under the Cumulative Condition generally 6 to 10°F cooler during September compared to the Environmental Baseline.

During this conference year, these cooler water temperatures under the Cumulative Condition would be more suitable during the summer, which includes portions of the spring-run Chinook salmon adult immigration and holding, spawning, and juvenile rearing and downstream movement lifestages.

Overall, relatively minor increases in simulated water temperatures with relatively low probabilities of occurrence are estimated to occur under the Cumulative Condition relative to the Environmental Baseline, and would represent a low stressor to spring-run Chinook salmon under the Cumulative Condition.

8.4.1.3 Narrows 2 Operations

Under the Environmental Baseline, Narrows 2 operations were characterized as a low stressor to adult spring-run Chinook salmon. Under the Cumulative Condition, it is anticipated that Narrows 2 operations would remain as a low stressor to adult spring-run Chinook salmon.

8.4.1.4 Riparian Habitat and Instream Cover (Riparian Vegetation, Instream Woody Material)

The Amended FLA includes a condition to limit the amount of flow reduction (2.5 cm/day) from one day to the next to promote riparian vegetation seedling establishment during the period of April 1 through July 15. Reedy et al. (2016) identified a maximum recession rate of 2.5 cm/day, citing recommendations by Mahoney and Rood (1998) and Stella et al. (2006), for riparian vegetation seedling establishment.

The flow reduction measure applies to day-to-day release reductions when the previous day's flow is at or below 4,130 cfs, which is the combined release capacity of the Narrows 2 and Narrows 1 powerhouses, as measured at the Smartsville gage.

Daily flows under the Proposed Action and the Environmental Baseline were modeled over the entire simulation period (1976-2008). The Cumumlative Condition includes all of the measures in the Amended FLA, including the riparian vegetation recession flow rate reduction limits.

Under the Environmental Baseline, day-to-day stage reductions of greater than 2.5 cm occurred during 272 days, compared to 206 days under the Cumulative Condition. Therefore, the flow reduction rate limitation included in the Proposed Action resulted in about a 24 percent relative reduction in the number of days exceeding the 2.5 cm/day criterion. Because the criterion is only applied on some of the days, stage reductions greater than the target maximum reduction of 2.5 cm/day still occur.

Figure 8.4-7 is an exceedance probability plot of the amount of stage reduction per day for the Cumulative Condition and the Environmental Baseline. The exceedance distributions demonstrate the probability of occurrence (percent) of stage reductions exceeding a specified daily amount. They include the full range of daily flow reduction rates (cm/day) and are not limited to days when flows are less than 4,130 cfs (i.e., a total of 3,498 days included in the period of evaluation, or 106 days per year for the 33-year simulation period). Approximately 10 percent of the time the Cumulative Condition results in lower rates of flow reduction (cm/day) than the Environmental Baseline. From April 1 through July 15 over the 33-year evaluation period, the Cumulative Condition would result in a flow reduction rate of 2.5 cm/day or less about 90 percent of the time, compared to 86 percent of the time under the Environmental Baseline.

Riparian vegetation seedling establishment recession rates are somewhat improved under the Cumulative Condition relative to the Environmental Baseline. Because spring recession rates of 2.5 cm/day or less are estimated to occur about 90 percent of the time, riparian vegetation recession rates represent a low stressor under the Cumulative Condition.

Under the Environmental Baseline, riparian vegetation and LWM, related primarily to the historical effects of upstream hydraulic mining on the channel geomorphology, and the existence of multiple large dams upstream, provide reduced habitat complexity and diversity, which potentially limits the productivity of juvenile salmonids. The limited availability of riparian habitat and instream cover (in the form of LWM) is a stressor that is manifested every year. Consequently, it was concluded that riparian habitat and instream cover are a stressor of moderate to high magnitude to Yuba River juvenile spring-run Chinook salmon under the Environmental Baseline. Under the Proposed Action (and also the Cumulative Condition), implementation of YCWA's Proposed Condition AR9 is expected to eventually improve riparian vegetation recruitment by restricting flow reductions during the riparian vegetation seedling establishment period to rates proposed by USFWS/Cal Fish and Wildlife (October 2015) of a stage decrease less than 2.5 cm/day.

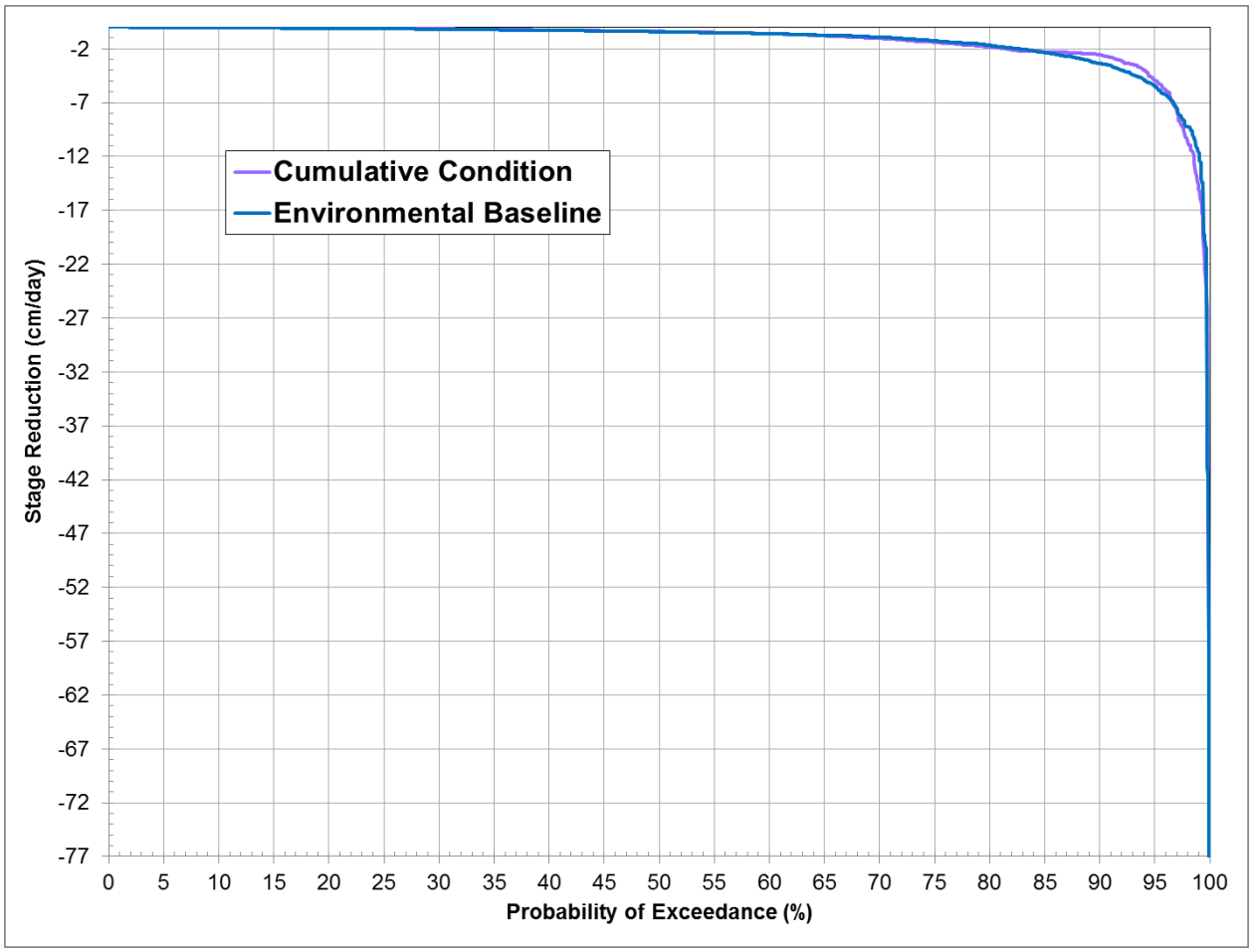

Figure 8.4-7. Exceedance probability of specified daily stage reductions (cm/day) from April 1 through July 15 under the Cumulative Condition and the Environmental baseline over the 33-year period of evaluation.

Although the ability of the lower Yuba River to support riparian vegetation has been substantially reduced by the historic impacts from mining activities, the dynamic nature of the river channel results in periodic creation of high-value shaded riverine aquatic (SRA) cover for fish and wildlife (Beak 1989). Since completion of New Bullards Bar Reservoir, the riparian community (in the lower Yuba River) has expanded under summer and fall streamflow conditions that have generally been higher than those that previously occurred (SWRCB 2003). Comparison of aerial photographs from 1937 and 2010 (see Technical Memorandum 6-2) showed that for all of the reaches in the lower Yuba River downstream of the Narrows Canyon, the amounts of riparian vegetation have increased.

Under the Cumulative Condition, riparian habitat and instream cover would represent a moderate stressor to juvenile spring-run Chinook salmon in the lower Yuba River because of: 1) the slight anticipated improvement to riparian vegetation with the implementation of condition AR9 of the Proposed Action and the timeframe required for riparian vegetation establishment; and 2) the

potential continued increase in riparian vegetation observed in the lower Yuba River since the cessation of hydraulic mining and the construction of multiple large dams upstream.

8.4.1.5 Other Stressors

Stressors and their magnitudes, other than those described above, to spring-run Chinook salmon in the lower Yuba River under the Cumulative Condition that are the same as under the Environmental Baseline are presented in Table 8.4-9. Stressors that are different under the Cumulative Condition than under the Environmental Baseline are described immediately below.

Table 8.4-9. Non-flow dependent or water temperature stressors and associated magnitudes to spring-run Chinook salmon in the lower Yuba River under both the Environmental Baseline and the Cumulative Condition.

Stressor	Relative Magnitude
Passage Impediments/Barriers	
• Englebright Dam	Very High
• Daguerre Point Dam	High
Harvest/Angling	Low
Poaching	High
Hatchery Effects (genetic considerations and straying)	High
Physical Habitat Alteration (Waterway 13 and Lake Wildwood)	Low to Moderate
Fry and Juvenile Rearing Physical Habitat Structure	High
Entrainment	
• BVID diversion	Low
• Hallwood-Cordua and South Yuba/Brophy diversions	Low
Predation	Moderate to High
Natural River Morphology and Function	High
Floodplain Habitat Availability	High

8.4.2 Steelhead

8.4.2.1 Flow-Dependent Habitat Conditions

8.4.2.1.1 Spawning Habitat

Spawning WUA for steelhead was evaluated for simulated flows up to 5,000 cfs, which generally represents the bankfull flow in the lower Yuba River. During the January through April steelhead spawning period, flows exceed 5,000 cfs during about 22 and 21 percent of the days over the 33-year simulation period for the Cumulative Condition and the comparative Environmental Baseline scenario, respectively. Table 8.4-10 displays the long-term average and average by WYT of steelhead spawning WUA (percent of maximum) under the Cumulative Condition and Environmental Baseline scenarios.

Table 8.4-10. Long-term and water year type average steelhead spawning WUA (percent of maximum) under the Cumulative Condition and Environmental Baseline scenarios.

Scenario	Long-term Full Simulation Period[2]	WYTs[1]				
		Wet	Above Normal	Below Normal	Dry	Critical
Cumulative Condition	92.1	97.9	96.5	94.5	92.8	84.4
Environmental Baseline	91.5	97.9	96.0	94.1	91.2	83.9
Difference	0.6	0.0	0.5	0.4	1.6	0.5

[1] As defined by the Yuba River Index (YRI) WY Hydrologic Classification.
[2] Based on the WY 1976-2008 simulation period.

Over the entire 33-year simulation period, there is very little difference between the long-term average steelhead spawning habitat availability (percent of maximum WUA) in the lower Yuba River under the Cumulative Condition scenario (92.1 percent maximum WUA) relative to the Environmental Baseline scenario (91.5 percent maximum WUA). The Cumulative Condition also results in similar percentages of maximum WUA by WYT as the Environmental Baseline scenario, but does result in an increase in maximum WUA of 1.6 percent during dry WYs. Both the Cumulative Condition and the Environmental Baseline scenario provide 80 percent or more of maximum spawning WUA during all WYTs.

Habitat durations for steelhead in-channel spawning under the Cumulative Condition and Environmental Baseline scenarios are presented in Figure 8.4-8.

The Cumulative Condition scenario provides similar or higher amounts of spawning habitat availability as the Environmental Baseline scenario over most of the exceedance distribution, provides less habitat over about 5 percent of the lower end of the distribution, and provides substantially more habitat over the lowest <1 percent of the distribution when habitat is most limiting. Both the Cumulative Condition and Environmental Baseline scenarios achieve 80 percent or more of spawning maximum WUA about 85 percent of the time.

During the one conference year (WY 1977) in the simulated period of evaluation (WY 1976-2008), an average of 72.0 percent of steelhead maximum spawning WUA was provided under the Cumulative Condition scenario, compared to 73.6 percent provided under the Environmental Baseline scenario.

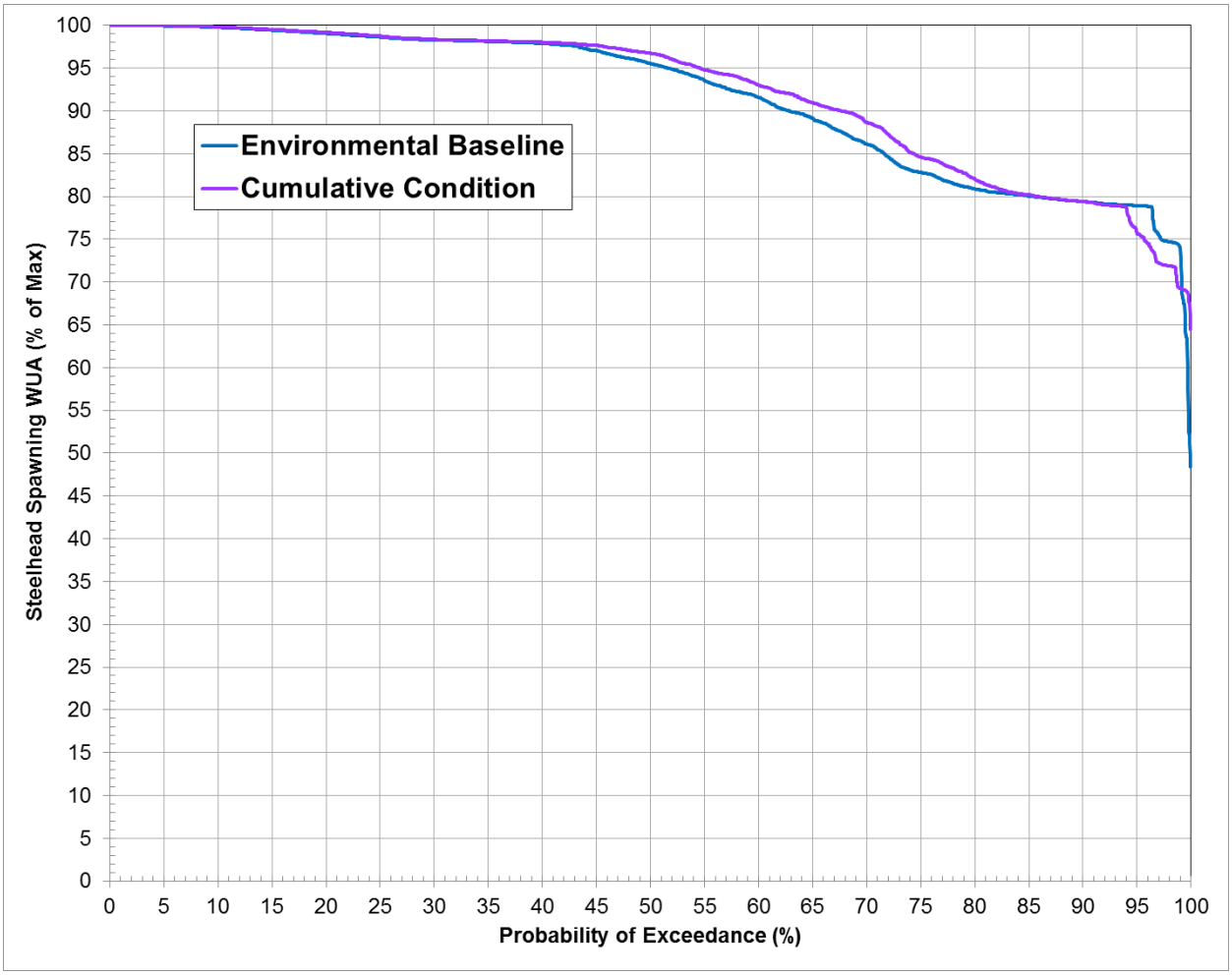

Figure 8.4-8. Steelhead spawning habitat duration over the 33-year hydrologic period for the Cumulative Condition and Environmental Baseline scenarios.

As discussed in Section 6.0, flow-dependent spawning habitat availability under the Environmental Baseline is a low stressor to Yuba River steelhead. Because of the general similarity or improvement in spawning habitat availability under the Cumulative Condition relative to the Environmental Baseline, this stressor would remain characterized as a low stressor under the Cumulative Condition.

8.4.2.1.2 Potential Redd Dewatering

For every day of the annual embryo incubation period, the long-term annual average of the percentage of steelhead redds potentially dewatered under the Cumulative Condition is slightly (0.30 percent) lower than the average under the Environmental Baseline. Applying the WY 1976-2008 average to the estimated 227 steelhead redds observed during surveys in the lower Yuba River during 2010, it is estimated that about 39 steelhead redds would potentially have been dewatered under the Cumulative Condition compared to an estimated 40 redds dewatered under the Environmental Baseline.

The highest estimated percentage of redds potentially dewatered occurs during wet WYTs for both the Cumulative Condition scenario (33.45 percent) and the Environmental Baseline scenario (34.80 percent) (Table 8.4-11). Under both the Cumulative Condition and the Environmental Baseline scenarios, the percentage of redds potentially dewatered generally decreases as the WYTs become drier from wet to critical. Small differences in steelhead redd dewatering would occur between the Cumulative Condition and the Environmental Baseline scenarios. The largest difference occurs during the wet WYs, when the average percentage of steelhead redds potentially dewatered under the Cumulative Condition would be 1.35 percent lower, relative to the Environmental Baseline.

Table 8.4-11. Estimated steelhead redd and egg pocket potential dewatering under the Cumulative Condition relative to the Environmental Baseline.

WYT Categories	Redd Dewatering Index (%)			Egg Pocket Dewatering Index (%)		
	Cumulative Condition	Environmental Baseline	Difference	Cumulative Condition	Environmental Baseline	Difference
Long-term (All WYs)	17.22%	17.52%	-0.30%	8.79%	8.98%	-0.19%
Wet	33.45%	34.80%	-1.35%	18.49%	19.68%	-1.19%
Above Normal	17.80%	16.97%	0.83%	8.27%	7.38%	0.89%
Below Normal	17.66%	17.62%	0.04%	8.94%	8.65%	0.29%
Dry	3.85%	4.42%	-0.57%	0.72%	0.75%	-0.03%
Critical	2.66%	2.26%	0.40%	0.75%	0.58%	0.17%

The long-term average percentage of egg pocket dewatering is very similar under the Cumulative Condition and Environmental Baseline scenarios (8.79 and 8.98 percent, respectively). The highest estimated percentage of egg pockets potentially dewatered occurs during wet WYTs for both the Cumulative Condition scenario (18.49 percent) and the Environmental Baseline scenario (19.68 percent). Potential egg pocket dewatering by WYT is similar, but slightly lower (up to 1.2 percent in wet WYs), under the Cumulative Condition relative to the Environmental Baseline.

During the one conference year (WY 1977) in the simulated period of evaluation (WY 1976-2008), no steelhead redds would potentially be dewatered under the Cumulative Condition, and an estimated 1.25 percent of steelhead redds would potentially be dewatered the Environmental Baseline. During this conference year, no egg pockets would potentially be dewatered under either the Cumulative Condition or the Environmental Baseline.The potential redd dewatering for steelhead is primarily due to high flow events (storm flows), which exceed the combined total flow capacity at Narrows 1 and Narrows 2 (4,130 cfs) that occur during the steelhead spawning and incubation period (i.e., January through May), and due to redd dewatering during those days when the conditions associated with Proposed Condition AR9 would not apply. Consequently, potential steelhead redd dewatering under the Cumulative Condition is estimated to be similar to that under the Environmental Baseline, and would not be exacerbated by the Cumulative Condition.

As discussed for spring-run Chinook salmon, Proposed Condition AR9 would not necessarily apply to every day each year of the embryo incubation period. During the days over the 33-year period of evaluation when this proposed condition would apply, it would provide the intended protection for steelhead redd dewatering (Table 8.4-12).

Table 8.4-12. Estimated steelhead redd and egg pocket potential dewatering under the Cumulative Conditon relative to the Environmental Baseline, for those days in the 33-year period of record during which the flow reduction criteria specified in Proposed Condition AR9 would apply.

WYT Categories	Redd Dewatering Index (%)			Egg Pocket Dewatering Index (%)		
	Cumulative Condition	Environmental Baseline	Difference	Cumulative Condition	Environmental Baseline	Difference
Long-term (All WYs)	0.38%	0.48%	-0.10%	0.05%	0.06%	-0.01%
Wet	0.16%	0.11%	0.05%	0.00%	0.00%	0.00%
Above Normal	0.31%	0.54%	-0.23%	0.06%	0.09%	-0.03%
Below Normal	0.13%	0.22%	-0.09%	0.00%	0.02%	-0.02%
Dry	0.38%	0.39%	-0.01%	0.05%	0.04%	0.01%
Critical	0.84%	1.14%	-0.30%	0.14%	0.17%	-0.03%

8.4.2.1.3 Fry and Juvenile Rearing Habitat Availability

Steelhead Fry Rearing In-Channel Habitat

During the April through July steelhead fry rearing period, flows exceed 5,000 cfs during about 12 percent of the days over the 33-year simulation period for the Cumulative Condition and Environmental Baseline scenarios. These days were excluded from the steelhead fry in-channel rearing WUA analysis. Table 8.4-13 displays the long-term average and average by WYT steelhead fry in-channel rearing habitat (percent of maximum WUA) under the Cumulative Condition and Environmental Baseline scenarios.

Table 8.4-13. Long-term and WYT average steelhead fry in-channel rearing WUA (percent of maximum) under the Cumulative Condition and Environmental Baseline scenarios.

Scenario	Long-term Full Simulation Period[2]	WYTs[1]				
		Wet	Above Normal	Below Normal	Dry	Critical
Cumulative Condition	83.2	81.6	82.0	81.2	83.6	86.1
Environmental Baseline	83.3	81.6	82.3	81.5	84.0	86.0
Difference	-0.1	0.0	-0.3	-0.3	-0.4	0.1

[1] As defined by the Yuba River Index (YRI) WY Hydrologic Classification.
[2] Based on the WY 1976-2008 simulation period.

Over the entire 33-year simulation period, long-term average fry in-channel rearing WUA in the lower Yuba River is very similar under the Cumulative Condition and Environmental Baseline. The Cumulative Condition scenario also results in similar fry in-channel rearing maximum WUA by WYT. Both the Cumulative Condition scenario and Environmental Baseline provide 80 percent or more of fry in-channel rearing maximum WUA during all WYTs.

Habitat durations for steelhead fry in-channel rearing under the Cumulative Condition and Environmental Baseline scenarios are presented in Figure 8.4-9. The Cumulative Condition and Environmental Baseline scenarios provide similar amounts of fry in-channel rearing habitat availability over most of the exceedance distribution, although the Cumulative Condition scenario provides more habitat over the lowest 1 percent of the distribution, relative to the Environmental Baseline scenario. Both the Cumulative Condition and Environmental Baseline scenarios achieve 80 percent or more of in-channel fry rearing maximum WUA with nearly a 75 percent probability.

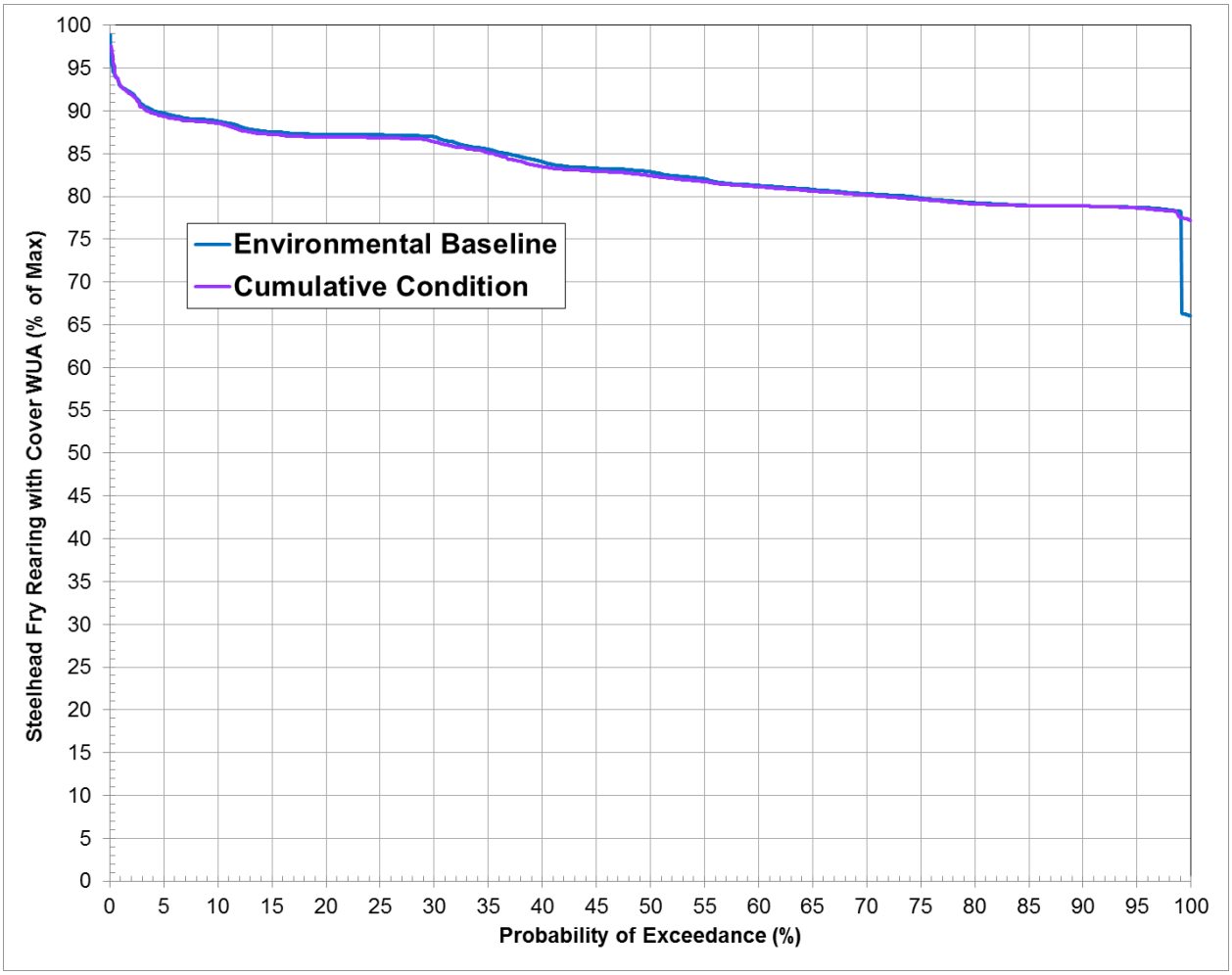

Figure 8.4-9. Steelhead fry in-channel rearing habitat duration over the 33-year hydrologic period for the Cumulative Condition and Environmental Baseline scenarios.

During the one conference year (WY 1977) in the simulated period of evaluation (WY 1976-2008), 87.3 percent of steelhead fry in-channel rearing maximum WUA was provided under the Cumulative Condition, compared to 86.2 percent provided under the Environmental Baseline.

Steelhead Fry Rearing Full-Flow Habitat

Table 8.4-14 displays the full-flow analysis of the average amounts (ac) of steelhead fry WUA without cover under the Cumulative Condition and the Environmental Baseline scenarios over the 33-year period of evaluation. Results are shown for all days, for days when flows were less than or equal to 5,000 cfs and for days when flows were greater than 5,000 cfs, and the differences between the two scenarios over the long-term full simulation period (all years) and by WYT.

Table 8.4-14. Long-term average WUA (ac) over the 33-year period of evaluation and WYT-specific relative contribution to the long-term average WUA of steelhead fry rearing habitat, under the Cumulative Condition and the Environmental Baseline.

Scenario	Long-term Full Simulation Period[2]	WYTs[1]				
		Wet	Above Normal	Below Normal	Dry	Critical
Cumulative Condition						
Total Days in Analysis	**4,026**	**1,342**	**610**	**488**	**610**	**976**
Days ≤ 5,000 cfs	3,551	940	557	468	610	976
Days > 5,000 cfs	475	402	53	20	0	0
Avg. WUA	**170.2**	**58.0**	**24.3**	**19.4**	**25.5**	**43.1**
WUA ≤ 5,000 cfs	145.6	36.7	21.8	18.5	25.5	43.1
WUA > 5,000 cfs	24.6	21.2	2.5	0.9	0.0	0.0
Environmental Baseline						
Total Days in Analysis	**4,026**	**1,342**	**610**	**488**	**610**	**976**
Days ≤ 5,000 cfs	3,527	933	542	466	610	976
Days > 5,000 cfs	499	409	68	22	0	0
Avg. WUA	**170.8**	**58.1**	**24.5**	**19.5**	**25.7**	**43.1**
WUA ≤ 5,000 cfs	145.0	36.5	21.3	18.5	25.7	43.1
WUA > 5,000 cfs	25.8	21.6	3.2	1.0	0.0	0.0
Differences						
Avg. WUA	**-0.6**	**-0.1**	**-0.2**	**-0.1**	**-0.2**	**0.0**
% change	**-0.4%**	**-0.2%**	**-0.9%**	**-0.6%**	**-0.8%**	**0.0%**

[1] As defined by the Yuba River Index (YRI) WY Hydrologic Classification.
[2] Based on the WY 1976-2008 simulation period.

For the entire simulation period, slightly lower amounts (0.4 percent) of fry rearing habitat (average WUA) are available under the Cumulative Condition compared to the Environmental Baseline. The Cumulative Condition results in similar but slightly lower (<1 percent) amounts of fry rearing habitat during all WYTs.

Figure 8.4-10 displays the full-flow analysis of the average amounts (ac) of steelhead fry weighted usable area (WUA) without cover under the Cumulative Condition and the Environmental Baseline. For both scenarios, a trend was observed of the most steelhead fry habitat occurring during wet WYs with decreasing amounts from wet to below normal WYTs,

then fry habitat increasing for dry and critical WYs. For both the Cumulative Condition and Environmental Baseline, relatively little to no additional fry rearing habitat is provided by days when flows were > 5,000 cfs for below normal, dry, and critical WYTs.

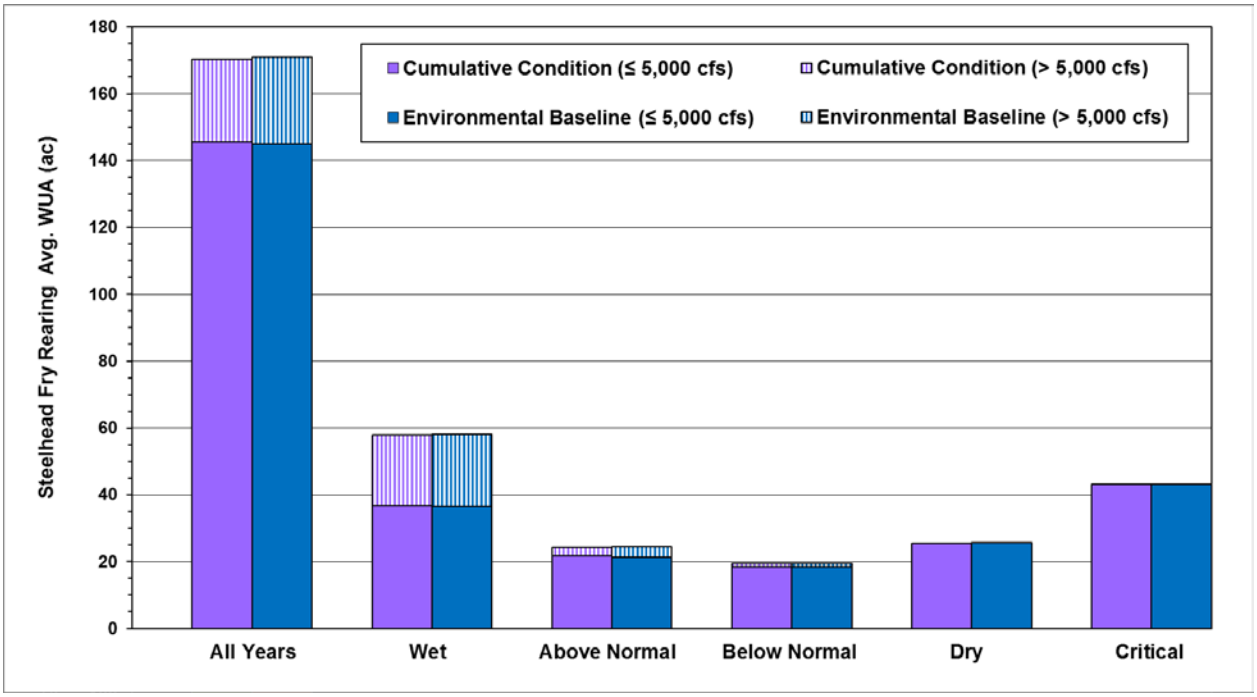

Figure 8.4-10. Comparison of the average amount (ac) of steelhead fry weighted usable area (WUA) without cover under the Cumulative Condition and the Environmental Baseline over the 33-year period of evaluation. Shown are the amounts over the long-term full simulation period (all years) and by WYT of habitat provided on days when flows were ≤ 5,000 cfs and for days when flows were > 5,000 cfs.

Steelhead Juvenile Rearing In-Channel Habitat

During the year-round steelhead juvenile rearing period, flows exceed 5,000 cfs during about 11 percent of the days over the 33-year simulation period for the Cumulative Condition and Environmental Baseline scenarios. These days were excluded from the steelhead juvenile in-channel rearing WUA analysis. Table 8.4-15 displays the long-term average and average by WYT steelhead juvenile in-channel rearing WUA (percent of maximum) under the Cumulative Condition and Environmental Baseline scenarios.

Over the entire 33-year simulation period, long-term average juvenile rearing WUA in the lower Yuba River is the same under the Cumulative Condition and Environmental Baseline scenarios (long-term average of 96.7 percent of maximum WUA). The Cumulative Condition scenario also results in very similar amounts of (percent of maximum) juvenile rearing habitat during all WYTs relative to the Environmental Baseline scenario. Both the Cumulative Condition and Environmental Baseline scenarios provide, on average, 80 percent (and even 95 percent) or more of maximum juvenile rearing WUA during all WYTs.

Table 8.4-15. Long-term and WYT average steelhead juvenile in-channel rearing WUA (percent of maximum) under the Cumulative Condition and Environmental Baseline scenarios.

Scenario	Long-term Full Simulation Period[2]	WYTs[1]				
		Wet	Above Normal	Below Normal	Dry	Critical
Cumulative Condition	96.7	95.6	95.6	96.7	97.9	97.8
Environmental Baseline	96.7	95.7	95.9	96.9	98.1	97.4
Difference	0.0	-0.1	-0.3	-0.2	-0.2	0.4

[1] As defined by the Yuba River Index (YRI) WY Hydrologic Classification.
[2] Based on the WY 1976-2008 simulation period.

Habitat duration for steelhead juvenile rearing under the Cumulative Condition and Environmental scenarios is presented in Figure 8.4-11. The Cumulative Condition and Environmental Baseline scenarios provide very similar amounts of juvenile rearing habitat availability over nearly the entire exceedance distribution. The Cumulative Condition and Environmental Baseline scenarios both achieve 80 percent (and even 90 percent) or more of juvenile in-channel rearing maximum WUA with about a 99 percent probability.

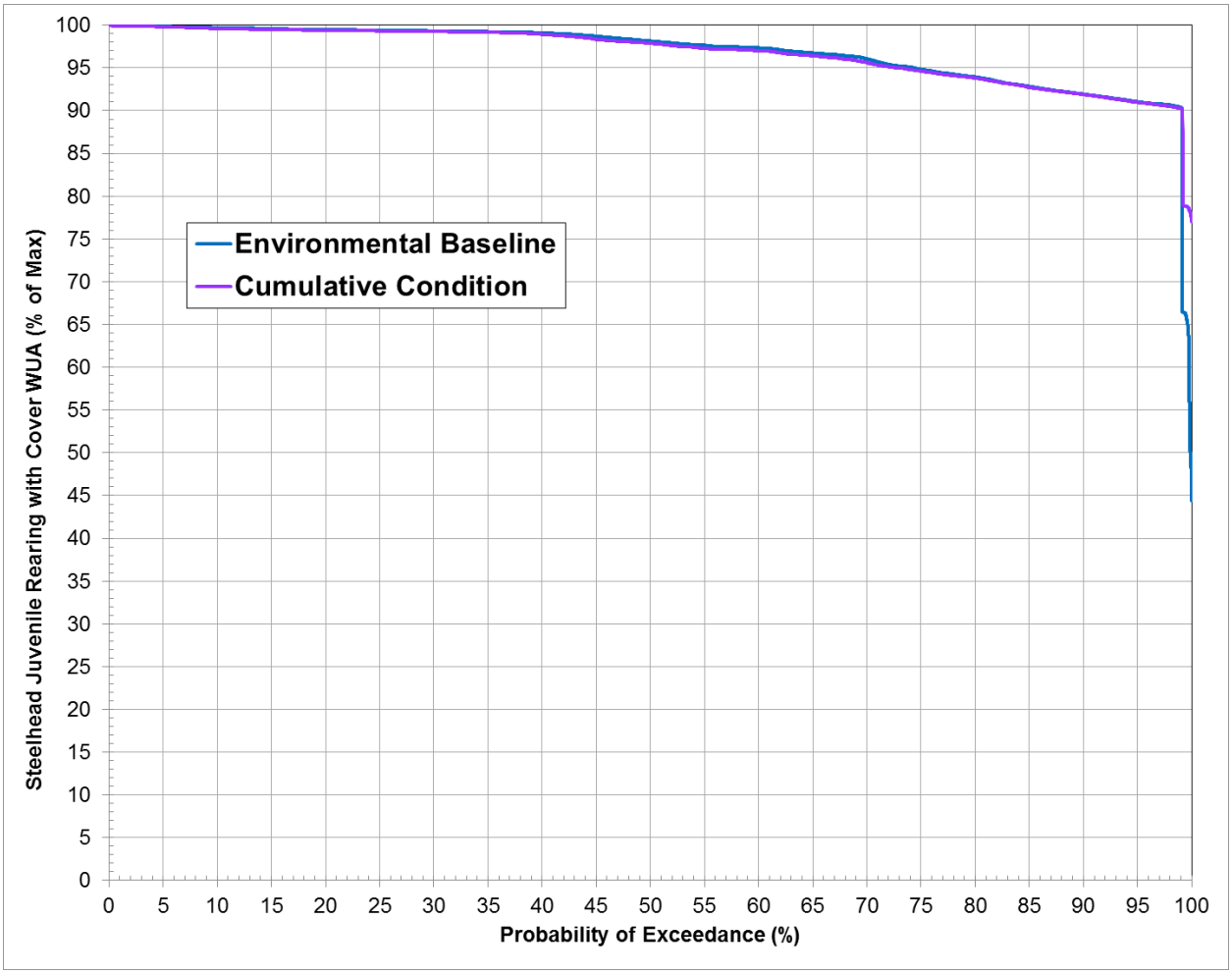

Figure 8.4-11. Steelhead juvenile in-channel rearing habitat duration over the 33-year hydrologic period for the Cumulative Condition and Environmental Baseline scenarios.

During the one conference year (WY 1977) in the simulated period of evaluation (WY 1976-2008), 92.9 percent of steelhead maximum juvenile in-channel rearing WUA was provided under the Cumulative Condition, compared to 88.3 percent provided under the Environmental Baseline.

Steelhead Juvenile Rearing Full Flow Habitat

Table 8.4-16 displays the full-flow analysis of the average amounts (ac) of steelhead juvenile WUA without cover under the Cumulative Condition and the Environmental Baseline over the 33-year period of evaluation. Similar amounts of juvenile rearing habitat (average WUA) are provided under the Cumulative Condition and the Environmental Baseline for the entire simuation period and all WYTs.

Table 8.4-16. Long-term average WUA (ac) over the 33-year period of evaluation and WYT-specific relative contribution to the long-term average WUA of steelhead juvenile rearing habitat, under the Cumulative Condition and the Environmental Baseline.

Scenario	Long-term Full Simulation Period[2]	WYTs[1]				
		Wet	Above Normal	Below Normal	Dry	Critical
Cumulative Condition						
Total Days in Analysis	**12,053**	**4,017**	**1,826**	**1,461**	**1,826**	**2,923**
Days ≤ 5,000 cfs	10,766	2,936	1,687	1,403	1,821	2,919
Days > 5,000 cfs	1,287	1,081	139	58	5	4
Avg. WUA	**260.8**	**86.6**	**37.9**	**31.1**	**40.0**	**65.2**
WUA ≤ 5,000 cfs	230.0	60.3	34.8	29.8	39.9	65.1
WUA > 5,000 cfs	30.9	26.3	3.1	1.3	0.1	0.1
Environmental Baseline						
Total Days in Analysis	**12,053**	**4,017**	**1,826**	**1,461**	**1,826**	**2,923**
Days ≤ 5,000 cfs	10,776	2,952	1,679	1,403	1,823	2,919
Days > 5,000 cfs	1,277	1,065	147	58	3	4
Avg. WUA	**261.4**	**86.9**	**38.0**	**31.3**	**40.3**	**65.0**
WUA ≤ 5,000 cfs	230.6	60.8	34.8	30.0	40.2	64.9
WUA > 5,000 cfs	30.8	26.1	3.2	1.3	0.1	0.1
Differences						
Avg. WUA	**-0.5**	**-0.3**	**-0.1**	**-0.1**	**-0.3**	**0.2**
% change	**-0.2%**	**-0.3%**	**-0.3%**	**-0.4%**	**-0.6%**	**0.3%**

[1] As defined by the Yuba River Index (YRI) WY Hydrologic Classification.
[2] Based on the WY 1976-2008 simulation period.

Figure 8.4-12 displays the full-flow analysis of the average amounts (ac) of steelhead juvenile WUA without cover under the Cumulative Condition and the Environmental Baseline. For both scenarios, decreasing amounts of total habitat were provided from wet to below normal WYTs, then increasing amounts were provided for dry and critical WYTs. For both the Cumulative Condition and the Environmental Baseline, relatively little to no additional juvenile rearing habitat is provided by days when flows were > 5,000 cfs for below normal, dry and critical WYTs.

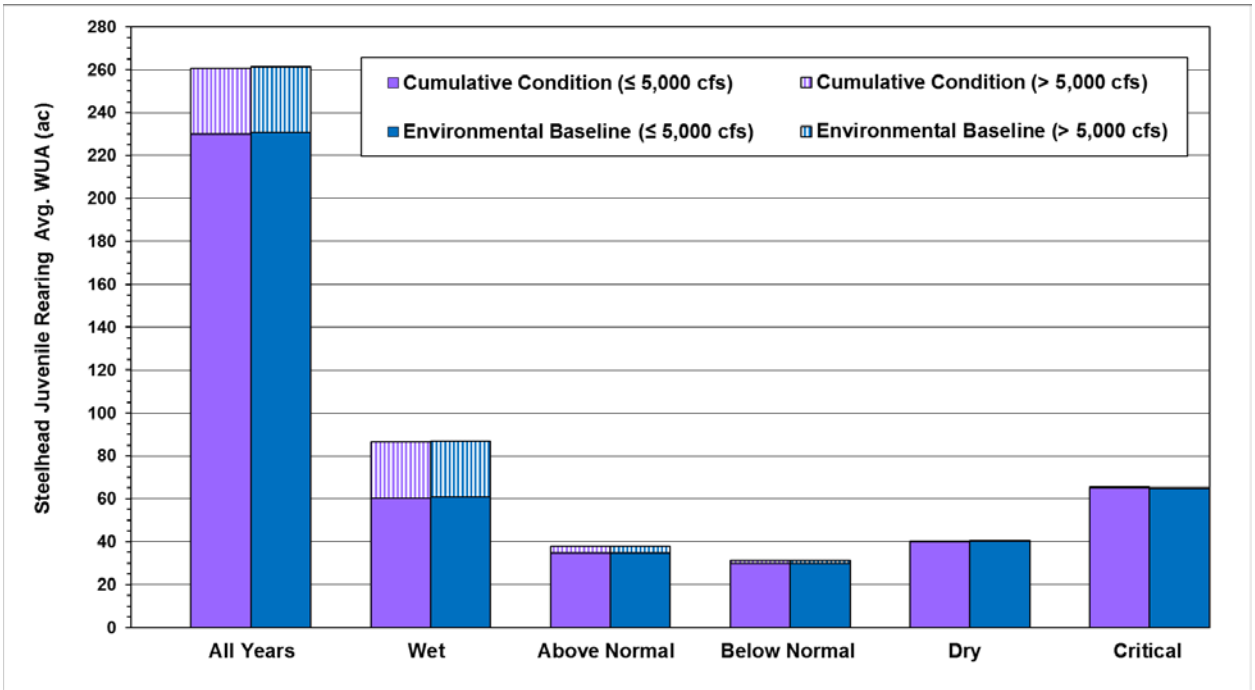

Figure 8.4-12. Comparison of the average amount (ac) of steelhead juvenile weighted usable area (WUA) without cover under the Cumulative Condition and the Environmental Baseline over the 33-year period of evaluation. Shown are the amounts over the long-term full simulation period (all years) and by water year type of habitat provided on days when flows were ≤ 5,000 cfs and for days when flows were > 5,000 cfs.

Fry and Juvenile Rearing Habitat as Stressors

Steelhead flow-dependent fry and juvenile rearing habitat availability under the Cumulative Condition is very similar to that under the Environmental Baseline. Flow-dependent fry and juvenile rearing habitat availability under the Cumulative Condition represents a low stressor to steelhead.

As a stressor, flow-dependent rearing habitat availability is distinct from rearing habitat physical structure. 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, continues to be a high stressor to rearing juvenile anadromous salmonids. Fry and juvenile rearing physical habitat structure under the Environmental Baseline is a high stressor to Yuba River steelhead, and will remain a high stressor under the various scenarios evaluated in this Applicant-Prepared Draft BA, including the Cumulative Condition.

8.4.2.1.4 Fry and Juvenile Stranding and Isolation

The lower maximum authorized ramping rate under the Proposed Action is anticipated to reduce the potential for juvenile isolation in the lower Yuba River under the Cumulative Condition,

relative to the Environmental Baseline. The lower maximum authorized ramping rate may better allow juvenile salmonids to volitionally move out of off-channel areas.

As previously discussed for spring-run Chinook salmon, above, examination of all water years and averages by WYT indicates that the relative frequency of isolation events under the Cumulative Condition and Environmental Baseline scenarios are very similar. The frequency of isolation events generally decreases from wetter to drier WYTs under both the Cumulative Condition and Environmental Baseline scenarios.

It should be noted that these results are only an indicator of the potential for off-channel stranding of juvenile salmonids. As previously discussed, some off-channel areas may pose hazards to juveniles, while other off-channel areas may benefit juvenile growth and long-term survival, depending on many factors. Also, as discussed, the Proposed Action (and Cumulative Condition) is anticipated to reduce the potential for juveniles to be isolated associated with the reduction in flow ramping rate.

Under the Environmental Baseline, fry and juvenile stranding is a stressor of moderate magnitude to steelhead. Because the Cumulative Condition is anticipated to reduce the potential for stranding and isolation, the Cumulative Condition is expected to reduce the magnitude of this stressor, the potential "exposure" of steelhead to this stressor, and the effects of this stressor on steelhead critical habitat. Therefore, this stressor is expected to be reduced to a low to moderate magnitude stressor to steelhead in the lower Yuba River under the Cumulative Condition.

8.4.2.2 Water Temperature

8.4.2.2.1 Cumulative Condition Compared to the Environmental Baseline

Table 8.4-17 displays the differences in steelhead lifestage-specific WTI value exceedance probabilities under the Cumulative Condition relative to the Environmental Baseline (i.e., the probability of exceeding a WTI value under the Cumulative Condition minus the probability of exceeding that WTI value under the Environmental Baseline).

Table 8.4-17. Difference in simulated water temperature exceedance probabilities for steelhead lifestages under the Cumulative Condition scenario, relative to the Environmental Baseline scenario.

Steelhead Lifestage	Node	Upper Tolerable WTI Value	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Adult Migration	SMRT	68°F	0.0	0.0	0.0	0.0	0.0	0.0									0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Below DPD	68°F	0.0	0.0	0.0	0.0	0.0	0.0									-2.0	-0.9	-2.4	-2.8	0.0	0.0	0.0	0.0	0.0	0.0
	MRY	68°F	0.0	0.0	0.0	0.0	0.0	0.0									0.0	0.0	0.0	0.0	-1.0	0.0	0.0	0.0	0.0	0.0
Adult Holding	SMRT	65°F	0.0	0.0	0.0	0.0	0.0	0.0									0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Below DPD	65°F	0.0	0.0	0.0	0.0	0.0	0.0									0.0	0.0	-0.2	-0.4	-1.6	0.0	0.0	0.0	0.0	0.0
	MRY	65°F	0.0	0.0	0.0	0.0	0.0	0.0									3.0	3.0	3.4	1.6	-0.2	-0.4	0.0	0.0	0.0	0.0
Spawning	SMRT	57°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																
	Below DPD	57°F	0.0	0.0	0.0	0.0	0.0	0.4	-2.4	1.8																
Embryo Incubation	SMRT	57°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0														
	Below DPD	57°F	0.0	0.0	0.0	0.0	0.0	0.4	-2.4	1.8	4.2	1.7														
Juv. Rearing and Downstream Movmt.	Below DPD	68°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.4	-0.8	-2.5	-2.0	-0.9	-2.4	-2.8	0.0	0.0	0.0	0.0	0.0	0.0
	MRY	68°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	-1.0	0.0	0.0	0.0	0.0	0.0
Yearling+ Smolt Emigration	Below DPD	55°F	0.0	0.0	0.0	0.0	0.0	0.9	-3.4												0.8	5.1	-2.0	-2.2	0.0	0.0
	MRY	55°F	0.0	0.0	0.0	0.0	0.0	-0.6	-0.4												0.0	2.3	1.6	-2.6	-0.6	0.0

Water temperature exceedance probabilities are generally similar under the Cumulative Condition and Environmental Baseline during the fall through spring months (i.e., late November through mid-March) for all lifestages of steelhead. Relatively minor increases in the probabilities of simulated water temperatures exceeding specified WTIs occur under the Cumulative Condition, primarily during August and September (at Marysville) of the steelhead adult holding lifestage, and during late October of the yearling+ smolt emigration lifestage.

No increases occur in the probability of exceeding the specified WTI occur at Smartsville or Daguerre Point Dam during the steelhead adult holding lifestage. Although slight increases occur at Marysville during August and September portion of the steelhead adult holding lifestage, these slight increases in the probability of exceeding the 65°F WTI are less than 3.4 percent. Additionally, it is expected that adult steelhead would preferentially hold in areas farther upstream than Marysville.

During late October of the yearling+ smolt emigration lifestage, minor increases occur at both the Daguerre Point Dam and Marysville locations, although these slight increases in the probability of exceeding the 55°F WTI are less than 5.1 percent and 2.3 percent, respectively. However, it is expected that the majority of yearling+ steelhead outmigrants emigrate from the river with the first freshets of the year, which are most likely to occur during November.

Lifestage-specific WTI values are not exceeded more often with a 10 percent or greater probability during any half-month period for any steelhead lifestage under the Cumulative Condition, relative to the Environmental Baseline.

During the one conference year (WY 1977) in the simulated period of evaluation (WY 1970-2010), water temperature differences between the Cumulative Condition and the Environmental Baseline scenarios demonstrate similar patterns among the three evaluation locations (Smartsville, Daguerre Point Dam and Marysville). Relative to the Environmental Baseline, generally similar or slightly cooler water temperatures occur under the Cumulative Condition from October through July at Smartsville and Daguerre Point Dam, and from October through June at Marysville. After those dates, water temperatures deviate between the Cumulative Condition and the Environmental Baseline, with Cumulative Condition water temperatures becoming increasingly cooler through the remainder of the year. The largest differences occur at Marysville, with water temperatures under the Cumulative Condition generally 6 to 10°F cooler during September compared to the Environmental Baseline.

During this conference year, these generally cooler water temperatures under the Cumulative Condition would be more suitable during the summer, which includes portions of the steelhead adult migration and holding, and juvenile rearing and downstream movement lifestages.

Overall, under the Environmental Baseline, water temperatures are a low stressor to Yuba River steelhead. Although relatively minor decreases and increases in water temperatures with relatively low probabilities of occurrence are estimated to occur under the Cumulative Condition relative to the Environmental Baseline, this stressor would remain characterized as a low stressor under the Cumulative Condition.

8.4.2.3 Narrows 2 Operations

The Cumulative Condition does not include any changes to Narrows 2 operations, with the exception of the changes in instream flow requirements during conference years and more protective flow fluctuation criteria under the Proposed Action. As previously discussed for spring-run Chinook salmon, adult Chinook salmon have been observed at the outfall of Narrows 2 and potential effects have been identified associated with Narrows 2 operations in the proximate vicinity of Narrows 2 facilities. No observations or similar identification of potential effects has been performed for steelhead. At this time, Narrows 2 operations can be characterized as being a low stressor to steelhead.

8.4.2.4 Riparian Habitat and Instream Cover (Riparian Vegetation, Instream Woody Material)

As previously discussed for spring-run Chinook salmon, riparian vegetation seedling establishment recession rates are somewhat improved under the Cumulative Condition relative to the Environmental Baseline. Because spring recession rates of 2.5 cm/day or less are estimated to occur about 90 percent of the time, riparian vegetation recession rates represent a low stressor to steelhead under the Cumulative Condition.

Under the Environmental Baseline, riparian vegetation and LWM, related primarily to the historical effects of upstream hydraulic mining on the channel geomorphology, and the existence of multiple large dams upstream, provide reduced habitat complexity and diversity, which potentially limits the productivity of juvenile salmonids. Consequently, it was concluded that riparian habitat and instream cover are a stressor of moderate to high magnitude to Yuba River juvenile steelhead under the Environmental Baseline. Under the Proposed Action (and also the Cumulative Condition), implementation of YCWA's Proposed Condition AR9 is expected to eventually improve riparian vegetation recruitment by restricting flow reductions during the riparian vegetation seedling establishment period to rates proposed by USFWS/Cal Fish and Wildlife (October 2015) of a stage decrease less than 2.5 cm/day.

Under the Cumulative Condition, riparian habitat and instream cover would represent a moderate stressor to juvenile steelhead in the lower Yuba River because of: 1) the slight anticipated improvement to riparian vegetation with the implementation of condition AR9 of the Proposed Action and the timeframe required for riparian vegetation establishment; and 2) the potential continued increase in riparian vegetation observed in the lower Yuba River since the cessation of hydraulic mining and the construction of multiple large dams upstream.

8.4.2.5 Other Stressors

For the remaining stressors besides those that are flow-dependent or water temperature-related and that were previously addressed, the effects of the Cumulative Condition are generally similarfor steelhead in the lower Yuba River as for spring-run Chinook salmon. The magnitudes of the effects of these stressors on steelhead in the lower Yuba River under the Environmental Baseline are the same as under the Cumulative Condition, as indicated in Table 8.4-18. The Cumulative Condition would not affect the potential "exposure" of steelhead in the lower Yuba

River to these stressors, the magnitude of these stressors, or the effects of these stressors on its critical habitat, relative to the Environmental Baseline.

Table 8.4-18. Non-flow dependent or water temperature-related stressors and associated magnitudes to steelhead in the lower Yuba River under both the Environmental Baseline and Cumulative Condition.

Stressor	Relative Magnitude
Passage Impediments/Barriers	
• Englebright Dam	Very High
• Daguerre Point Dam	High
Harvest/Angling	Low
Poaching	Moderate
Hatchery Effects (genetic considerations and straying)	High
Physical Habitat Alteration (Waterway 13 and Lake Wildwood)	Low to Moderate
Fry and Juvenile Rearing Physical Habitat Structure	High
Entrainment	
• BVID diversion	Low
• Hallwood-Cordua and South Yuba/Brophy diversions	Moderate
Predation	Moderate to High
Natural River Morphology and Function	High
Floodplain Habitat Availability	High

8.4.3 Green Sturgeon

8.4.3.1 Adult Holding Habitat

Figure 8.4-13 displays the green sturgeon adult holding habitat exceedance distributions in the Yuba River downstream of Daguerre Point Dam for the Cumulative Condition and Environmental Baseline scenarios for the February through November potential green sturgeon adult pre-spawning holding, spawning and post-spawning holding periods.

Simulated adult green sturgeon holding habitat under the Cumulative Condition, relative to the Environmental Baseline, is very similar over nearly the entire distribution during the February through November period.

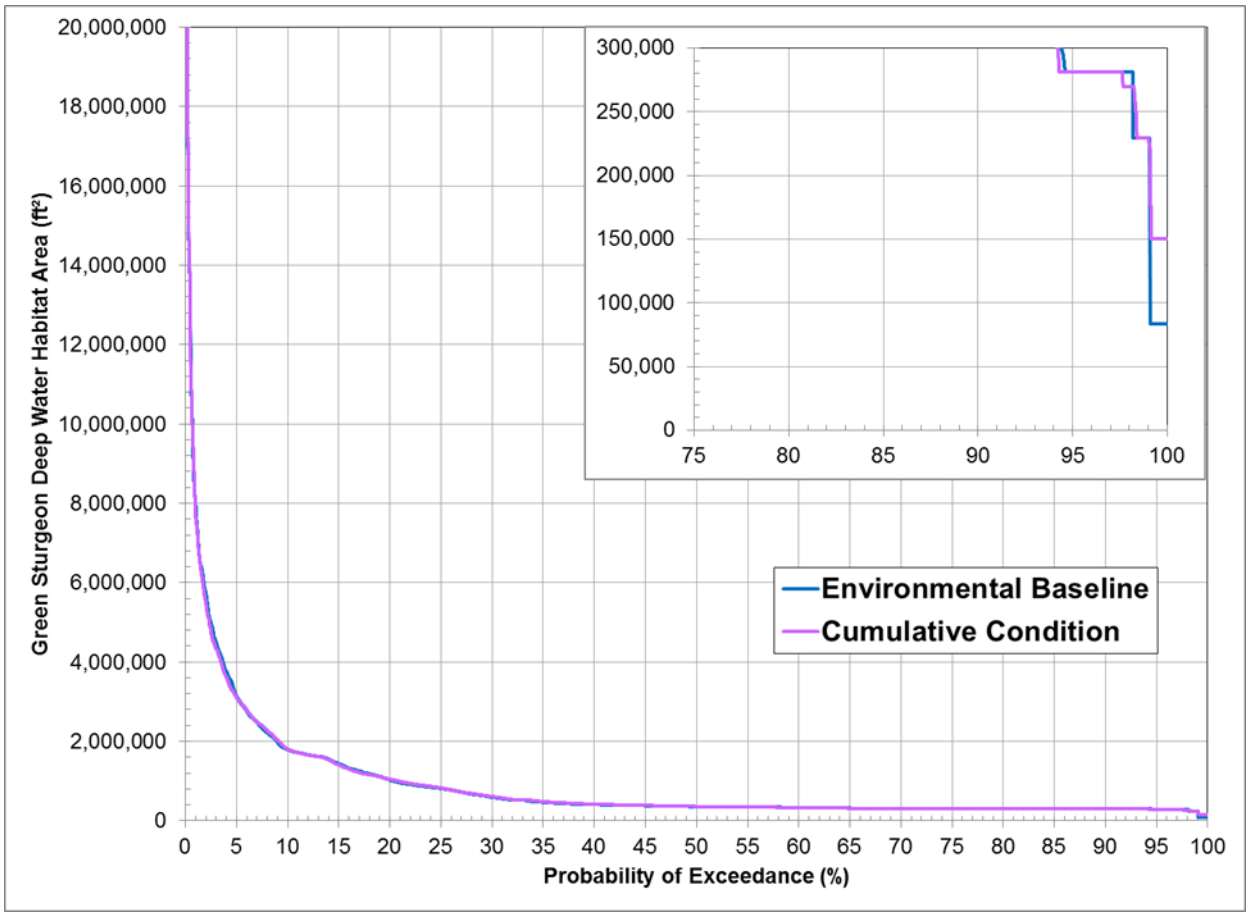

Figure 8.4-13. Simulated adult green sturgeon deepwater holding habitat exceedance during February through November for WY 1976 through 2008 under the Cumulative Condition and Environmental Baseline scenarios.

8.4.3.2 Spawning Habitat

Green sturgeon spawning WUA (within all MUs, and separately for pool MUs) exceedance curves are presented for both the Cumulative Condition and the Environmental Baseline scenarios for the March through July spawning period for the 33-year simulation period (Figures 8.4-14 and 8.4-15).

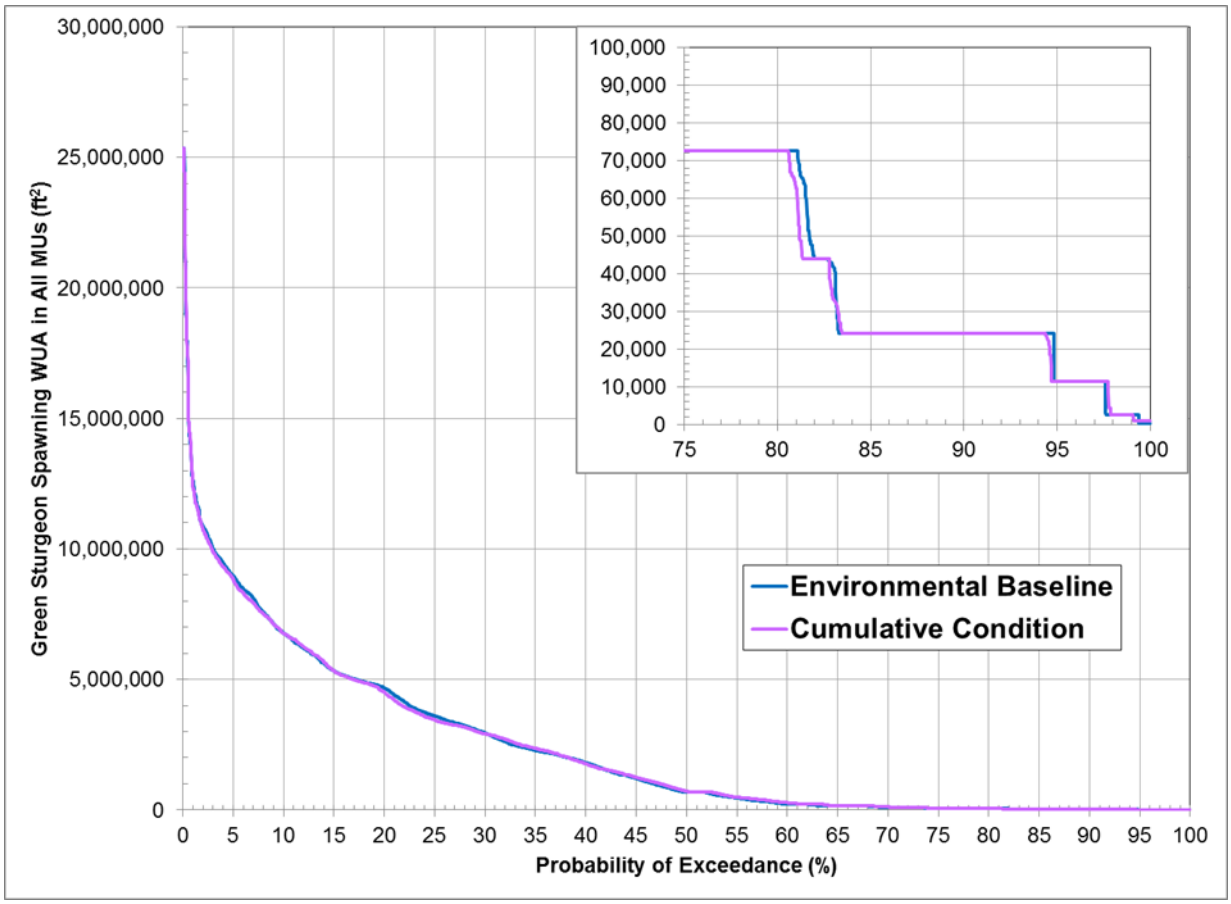

Figure 8.4-14. Simulated green sturgeon spawning WUA (in all morphological units) exceedance during March through July for WY 1976 through 2008 under the Cumulative Condition and Environmental Baseline scenarios.

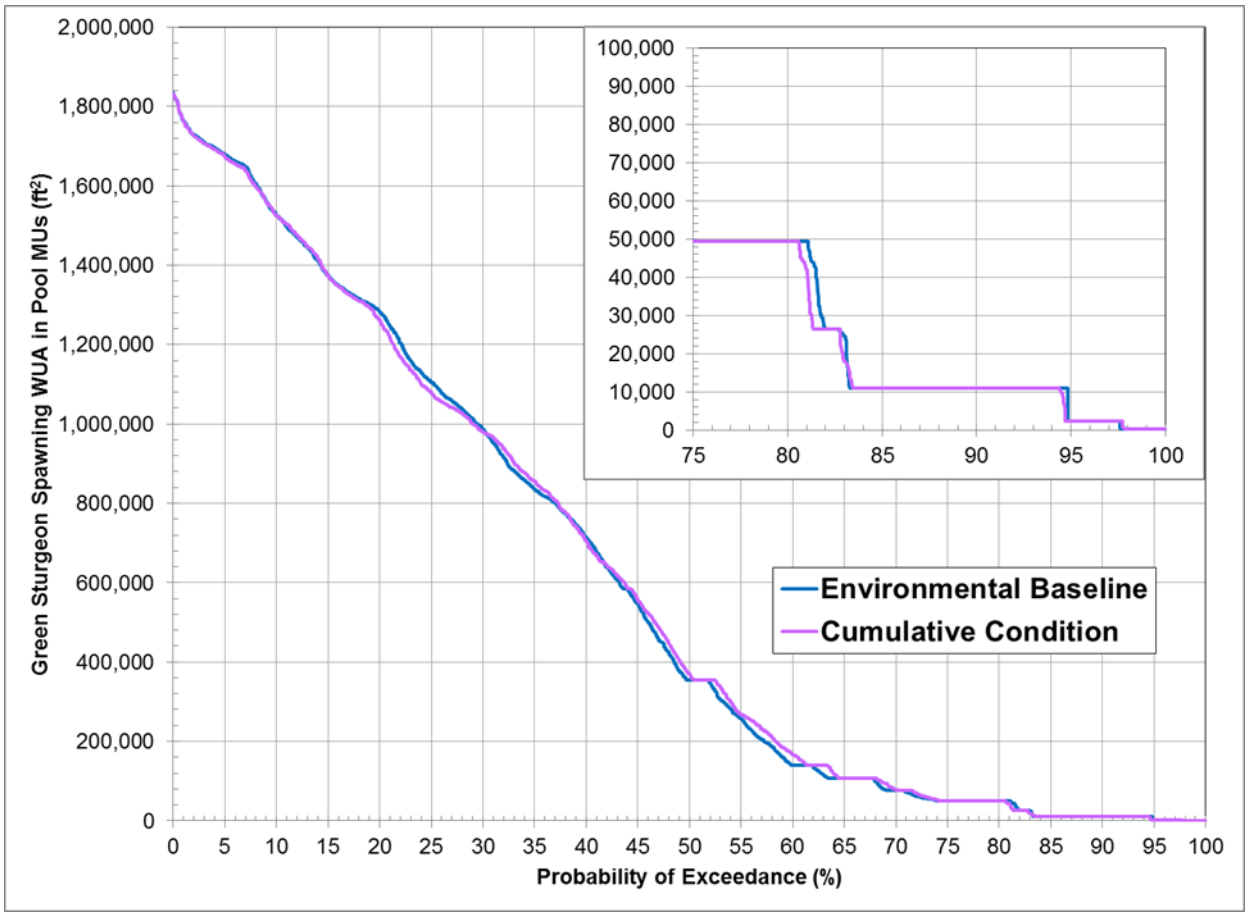

Figure 8.4-15. Simulated green sturgeon spawning WUA (in pool morphological units only) exceedance during March through July for WY 1976 through 2008 under the Cumulative Condition and Environmental Baseline scenarios.

Simulated adult green sturgeon spawning habitat (WUA) under the Cumulative Condition scenario is generally similar to the simulated spawning habitat under the Environmental Baseline scenario over nearly the entire distribution during March through July for all MUs, and for only pool MUs below Daguerre Point Dam. As shown in the above figures, the Cumulative Condition scenario results in minor reductions in habitat availability over relatively minor portions (less than about 2 percent) of the lower quartile of the distribution, relative to the Environmental Baseline scenario.

During the one conference year (WY 1977) in the simulated period of evaluation (WY 1976-2008), for analytical purposes the corresponding green sturgeon holding period extends from February through November of 1977. During that holding season, adult green sturgeon holding habitat during was, on average, slightly higher (233,383 ft^2 per day) under the Cumulative Condition scenario relative to the Environmental Baseline scenario (215,276 ft^2 per day).

During the one conference year (WY 1977) in the simulated period of evaluation (WY 1976-2008), the corresponding green sturgeon spawning period extends from March through July of

1977. During that spawning season, green sturgeon spawning WUA (all MUs) is, on average, lower under the Cumulative Condition scenario (8,342 ft^2 per day) relative to the Environmental Baseline scenario (10,636 ft^2 per day). For pool MUs only, green sturgeon spawning WUA also is lower on average under the Cumulative Condition scenario (3,610 ft^2 per day) relative to the Environmental Baseline scenario (5,703 ft^2 per day).

Simulated green sturgeon holding habitat and spawning habitat availability is generally similar between the Cumulative Condition and Environmental Baseline scenarios. Overall, under both scenarios, a substantial amount of deepwater pool habitat and spawning habitat is generally available downstream of Daguerre Point Dam. While there is less spawning habitat available when the analysis is restricted only to pool MUs, the application of the green sturgeon spawning HSCs without restriction to pool morphological units likely provides the best available green sturgeon spawning WUA estimate in the Yuba River downstream of Daguerre Point Dam, for the following reasons: 1) the identification of the pool MU was not intended to specifically represent green sturgeon spawning pool habitat; 2) the definition of the pool MU is unduly restrictive regarding application of the green sturgeon spawning HSCs (i.e., particularly the velocity criterion) agreed to by the Relicensing Participants; and 3) the pool MU was identified based on hydraulics, including velocity, at a flow of 530 cfs below Daguerre Point Dam. Further discussion of the appropriateness of applying green sturgeon spawning HSCs to pool MUs is provided in Technical Memorandum 7-9, *Green Sturgeon Downstream of Englebright Dam*. Therefore, the simulated estimates of green sturgeon spawning WUA that include all MUs are expected to better represent potential green sturgeon spawning habitat availability.

8.4.3.3 Water Temperature

8.4.3.3.1 Cumulative Condition Compared to the Environmental Baseline

Table 8.4-19 displays the differences in green sturgeon lifestage-specific WTI value exceedance probabilities under the Cumulative Condition relative to the Environmental Baseline (i.e., the probability of exceeding a WTI value under the Cumulative Condition scenario minus the probability of exceeding that WTI value under the Environmental Baseline scenario).

Table 8.4-19. Difference in simulated water temperature exceedance probabilities for green sturgeon lifestages under the Cumulative Condition scenario relative to the Environmental Baseline scenario.

Green Sturgeon Lifestage	Node	Water Temperature Value	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Adult Immigration and Holding	Below DPD	61°F				0.0	0.0	0.0	0.0	0.0																
	MRY	61°F				0.0	0.0	0.0	-1.4	-0.2																
Spawning and Embryo Incubation	Below DPD	63°F					0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	0.0	0.0										
	MRY	63°F					0.0	0.0	-0.4	0.0	0.0	0.6	-1.4	0.6	2.6	5.7										
Post-Spawning Holding	Below DPD	61°F					0.0	0.0	0.0	0.0	0.0	0.0	-1.2	0.0	1.2	4.0	1.8	2.7	6.1	6.9	0.4	-1.3	0.0	0.0		
	MRY	61°F					0.0	0.0	-1.4	-0.2	0.8	1.7	-0.6	0.0	4.0	9.7	12.7	9.7	5.9	17.8	11.7	0.0	-0.6	0.0		
Juv. Rearing and Outmigration	Below DPD	66°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	-0.2	0.0	0.0	0.0	-0.2	-1.6	-0.8	0.0	0.0	0.0	0.0	0.0
	MRY	66°F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	1.4	2.7	0.6	-0.2	0.0	0.8	-1.6	0.0	0.0	0.0	0.0	0.0

Water temperature exceedance probabilities are generally similar under the Cumulative Condition scenario and the Environmental Baseline scenario during the fall through spring

months (i.e., November through May). Under the Cumulative Condition scenario, water temperatures exceed the specified index value for post-spawning holding at Marysville somewhat more often during July through mid-October, including exceedance of the index value with a 10 percent or more probability of occurrence early August, late September, and early October, relative to the Environmental Baseline scenario. However, potential green sturgeon post-spawning holding would likely occur near Daguerre Point Dam, the only location where adult green sturgeon have been infrequently observed, and where water temperatures are generally suitable.

As previously discussed, there are additional considerations pertinent to the water temperature suitability evaluations for green sturgeon. According to NMFS' designation of North American green sturgeon critical habitat, the proper functioning of freshwater habitat did not even include water temperature for adult holding or post-spawning holding. Also, the use of 61°F as the specified WTI for the pre-and post-spawning holding lifestages may be overly rigorous, considering that the spawning WTI itself was established as 63°F.

Slight increases and decreases in water temperature exceedance probabilities occur during the spawning and embryo incubation and juvenile rearing and outmigration lifestages under the Cumulative Condition scenario relative to the Environmental Baseline scenario, but do not result in changes in exceedance of 10 percent or more.

During the one conference year (WY 1977) in the simulated period of evaluation (WY 1976-2008), relative to the Environmental Baseline, generally similar or slightly cooler water temperatures occur under the Cumulative Condition from October through July at Daguerre Point Dam, and from October through June at Marysville. After those dates, Cumulative Condition water temperatures become increasingly cooler through the remainder of the year. The largest differences occur at Marysville, with water temperatures under the Cumulative Condition generally 6 to 10°F cooler during September compared to the Environmental Baseline. During this conference year, these generally cooler water temperatures under the Cumulative Condition would represent more suitable water temperatures during the summer, which includes portions of the green sturgeon spawning, post-spawning holding, and juvenile rearing and outmigration lifestages.

8.4.4 Other Future Non-Federal Activities in the Yuba River Basin

The following potential activities could be considered to have the potential to affect flows or other conditions in the lower Yuba River. Much of the following information was updated from a completed BA by the Corps (2013a) on its authorized maintenance and operation activities at Daguerre Point Dam.

8.4.4.1 BVID Dry Creek Recapture Project

Browns Valley Irrigation District is planning a tailwater recapture project that will relieve irrigation water supply constraints by pumping water from French Dry Creek ("Dry Creek") at times when Dry Creek flows are primarily composed of tailwater from irrigated lands draining to Little Dry Creek (BVID 2017).

BVID would convey recycled flows from a pumping plant on Dry Creek to rice fields presently irrigated exclusively by diversions from the lower Yuba River. The warmer reclaimed water would be delivered into BVID's Pipeline Canal and applied by its customers to rice lands where the elevated water temperatures benefit rice production. Application of tailwater recaptured from Dry Creek to the agricultural lands within BVID's service area would reduce the district's demand for water diverted directly from the lower Yuba River, thus balancing the reduction in inflows to the river that would result from pumping this water from Dry Creek with an equivalent reduction in diversion from the Yuba River. The Project is of regional significance because it would reduce diversions from the lower Yuba River (Yuba County 2007).

The project proposes to recapture up to a maximum of 10 cfs of irrigation return flow from Dry Creek during the irrigation season, which typically runs from April through October (BVID 2017). It is estimated that the influx of irrigation return flow would raise Dry Creek's temperature by an average of 4–5ºC and introduces sediments, nutrients, and other constituents into Dry Creek approximately 1.8 mi upstream of its confluence with the lower Yuba River (BVID 2017). By pumping water from Dry Creek downstream of the confluence with Little Dry Creek when Dry Creek flows are primarily comprised of return water from irrigated lands, the project is expected to improve water quality by removing some of the thermal and pollutant load from Dry Creek before it reaches the lower Yuba River. BVID would continue to meet existing minimum flow requirements with releases of cool, good quality water from Collins Lake. Any time that BVID is recapturing irrigation return water, there would be an equal and concurrent reduction in BVID's diversions from the Yuba River at its Pumpline facilities (BVID 2009). Use of the recaptured return water for the rice fields would reduce BVID diversions of cool surface water from the lower Yuba River, and this substitution would retain cool water in the lower Yuba River, which could benefit fisheries resources and aquatic habitat (BVID 2009).

8.4.4.2 The Trust for Public Lands Excelsior Project

The Excelsior Project is a collaborative conservation effort on the lower Yuba River, featuring 924 ac of wetlands, oak woodlands, gold-rush archeological remnants, and miles of salmon habitat (Excelsior Chronicles 2010). As many as 60 homes were planned along the lower Yuba River on the property once owned by the Excelsior Mining Company. The Trust for Public Lands, in collaboration with Cal Fish and Wildlife, intends to turn part of the land over to the University of California Sierra Field Research Extension Station for salmon studies and restoration work before eventually opening it to the public (Fimrite 2009). The California Wildlife Conservation Board, in concert with the Trust for Public Lands, voted to acquire the 528-ac Yuba Narrows Ranch, ensuring that this property would be permanently protected as open space. In July of 2011, Cal Fish and Wildlife acquired the Yuba Narrows Ranch, which includes frontage along almost two miles of salmon habitat along the lower Yuba River, and will be managed and permanently protected as open space. The conservation easement will permit access from Highway 20 into the Yuba Narrows Ranch, providing miles of hiking and acres of recreational opportunities. The property is well known for its scenic beauty and attractiveness to fisherman for its Chinook salmon and steelhead. It offers recreational boaters and hikers with panoramic views of the river, Rose Bar Bridge to the west, and the Englebright Dam on the east. The acquisition also provides connections to over five miles of recreational areas previously deemed inaccessible (CDFG 2010a). The site is representative of early California history and

includes a traversable Miner's Trail that was constructed and used by miners during the California Gold Rush. It is anticipated that portions of the property, including the Miner's Ditch Trail, will become open to public access. Remnants of an historic Chinese wall and mining tunnel also remain intact on the property from California's gold mining past (CDFG 2010b).

Additionally, in 2012, the Bear-Yuba Land Trust acquired Phase 1 the historic 157-ac Black Swan Ranch portion of the Excelsior property, which is located near the confluence of Deer Creek and overlooks Englebright Reservoir and the lower Yuba River (Excelsior Project 2013). In 2013, the Wildlife Conservation Board purchased Phase 2 of the Black Swan, in collaboration with the Cal Fish and Wildlife. In 2016, the Bear-Yuba Land Trust purchased an additional 15 ac of wetland habitat west of the Black Swan Preserve, resulting in a total of over 700 ac of permanently conserved and publically accessible land. Trails and parking areas are under development (Excelsior Project 2017).

Beginning in the fall of 2011, conservation easements were placed on parcels of the Excelsior Ranch. The blue oak woodlands that occupy the large majority of the Excelsior Ranch will be permanently protected as open space, and managed jointly by the Ranch's steward-owners, who will also play a significant role in oversight of the Black Swan and Yuba Narrows conservation areas. In this way, more than 870 ac (over 95 percent) of the Excelsior property will be permanently protected as open space (Excelsior Project 2017).

Although the adjacent Yuba Narrows and Black Swan Ranches are now protected, the Blue Point Mine, located on private property, is identified as an additional area of potential conservation (Excelsior Project 2017). Despite its cultural and historical values, the Blue Point Mine is zoned for five-acre residential development and has a valid use permit to operate as a quarry. The Excelsior Foundation has a larger vision for the Blue Point Mine area – that the 505 ac of natural and historical resources, ditches and trails, escarpments and lower Yuba River access, be permanently protected and made available to the public to create over 1,200 ac of conservation area (Excelsior Project 2017). The Excelsior Foundation continues its efforts to preserve and protect the Blue Point Mine area (Excelsior Project 2017).

8.4.4.3 Yuba Goldfields Sand and Gravel Mining Operations and Reclamation Projects

The Yuba Goldfields area is designated and zoned "Extractive Industrial" under the Yuba County General Plan, which allows surface mining as a permitted use. Operators within and adjacent to the Yuba Goldfields currently supply construction materials, including asphaltic concrete, to projects within southern Placer and Yuba counties. The following five aggregate mines (Figure 8.4-16, SMGB 2014) in the Yuba Goldfields are considered for purposes of the cumulative effects analysis.

- Teichert Marysville Aggregate Mining Site and Reclamation Project (590 ac, located southwest of and adjacent to the Western Aggregates operation)
- Teichert Hallwood Mine and Reclamation Project (up to 752 ac, located approximately 3 miles northeast of Marysville and adjacent to the north bank of the Yuba River)

- Western Aggregates Hallwood Mine and Amended Reclamation Plan (520 ac, located on the north side of the lower Yuba River)
- Knife River (formerly Baldwin) Hallwood Mine and Reclamation Project (202 ac, located adjacent to the Teichert Hallwood operation)
- Dantoni Property Mine and Reclamation Project (180 ac, located adjacent to the western boundary of Western Aggregates operation)
- Cal Sierra Development Mine and Reclamation Project (1,420 ac, located on and adjacent to the Western Aggregates Amended Reclamation Plan area)

Each of these projects is a surface mine or reclamation operation located in the Yuba Goldfields that has the potential to result in physical changes to aquatic habitat in the vicinity of the lower Yuba River.

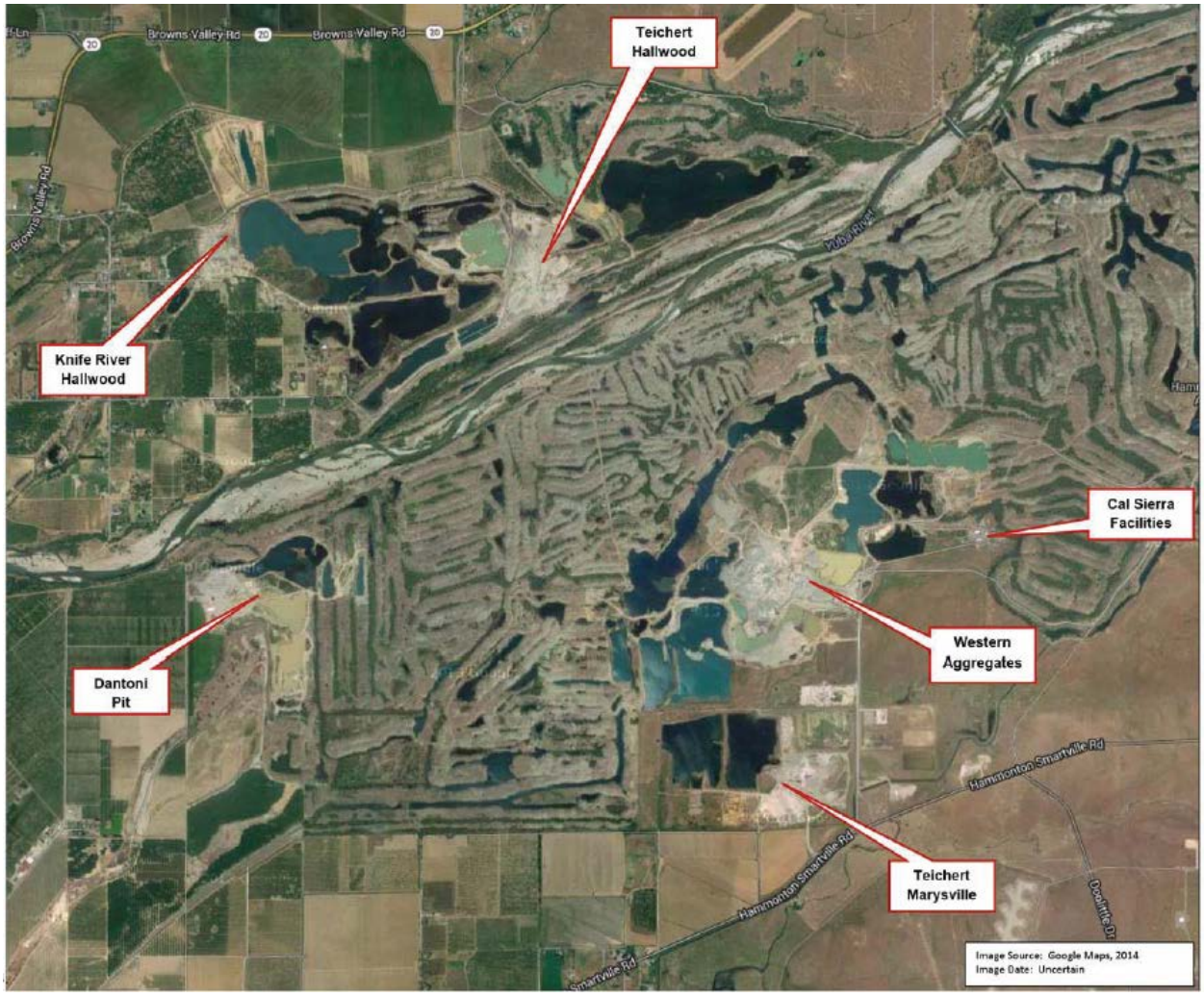

Figure 8.4-16. Aggregate mines in the Yuba Goldfields (Source: SMGB 2014).

8.4.4.3.1 Teichert Aggregates and Teichert Materials

Teichert Aggregates mines and processes sand and gravel deposits in addition to hard rock, immediately adjacent to the Yuba Goldfields approximately five miles northeast of Marysville, California, and two miles south of the Yuba River. The mine operates on an approximately 590-ac site and mines to depths of approximately 200 ft (Placer County 2007; SMGB 2014). Mining operations use pit dewatering techniques, and/or draglines and hydraulic excavators to extract mined materials in saturated conditions (below groundwater levels). According to Placer County (2007), production is 500,000 tons per year (t/y) to 1 million tons per year (mty) depending on specific market demands. For purposes of assessing cumulative effects, it was previously assumed that this facility would be operating at its maximum estimated production rate of 1 mty (Placer County 2007). Reclamation of the Teichert Marysville site will create open water with shoreline habitat encompassing approximately 420 ac of the site (SMGB 2014).

Teichert Materials Inc.'s operations of the Hallwood Plant near Marysville, California, mines aggregate on 752 ac in the Yuba Goldfields along the banks of the lower Yuba River, producing crushed stone, sand, and gravel (Aggregates Manager 2014; SMGB 2014). Approximately 488 ac of the project site are considered by Teichert to be mineable (SMGB 2014). A contiguous ridge of dredger tailings along the north bank of the Yuba River south of the mining operations (locally referred to as a "training wall") separates mining and reclamation activities from the Yuba River. Due to the economic downturn several years ago, the Hallwood Plant became more efficient, and production was reduced to about one quarter of its permitted limits during 2014 (Aggregates Manager 2014). Although sales or aggregate occur year-round, the processing plant only operates for seven to nine months a year. When the processing plant shuts down at the end of the year, a month is spent making repairs to the plant equipment (Aggregates Manager 2014).

The reclamation plan for Teichert Materials Inc.'s Hallwood Plant assumes that the estimated quantity of aggregate to be mined on the project site is approximately 57 million tons (SMGB 2014). The maximum depth of surface mining operations will be approximately 200 feet below dry season groundwater levels. When excavation exceeds depths of 60 feet below the groundwater table, a dredge will be used. Wet mining operations will create areas of open water in the West Lake, East Lagoon, and Lower Fin portions of the project site. Only West Lake would be excavated to a depth of approximately 200 feet below groundwater, with the depth of East Lagoon and Lower Fin limited to approximately 60 feet below groundwater. Mining operations will be conducted in four separate phases based on the locations of viable aggregate material and operational considerations (SMGB 2014). Reclamation will generally occur concurrently with mining operations within each phase as mining in specific areas is completed. Reclamation and revegetation will commence in areas where mining activities are complete and future disturbance from adjacent activities can be avoided. Upon completion of mining operations and implementation of the reclamation plan, the Hallwood site would consist of natural buffer areas around three lakes of varying sizes and depths. The two largest lakes, West Lake and East Lagoon, will cover approximately 134 ac and 83 ac, respectively. In accordance with the reclamation plan, the site would ultimately support 5.5 ac of emergent marsh habitat, 44.0 ac of riparian wetland habitat, and 25.7 ac of riparian upland habitat (SMGB 2014).

8.4.4.3.2 Western Aggregates

The Western Aggregates facility mines and processes sand and gravel deposits within the Yuba Goldfields south of the Yuba River and north of Hammonton-Smartville Road (Placer County 2007). The mine operates an active aggregate (sand and gravel) mining operation pursuant to vested rights, which were confirmed in 2010 by the State Mining and Geology Board (SMGB) to cover an approximately 3,900-ac area (Western's Vested Rights Area) situated in the Yuba Goldfields (SMGB 2014). Mined aggregate material is hauled to an onsite processing plant that includes crushers, screeners, and a conveyor. The mitigated negative declaration for the mine (adopted March 23, 1977) estimated the mining rate to be about 600,000 t/y (Placer County 2007).

In 2008, Western Aggregates and SYRCL, along with the Yuba River Preservation Foundation and Yuba Outdoor Adventures, signed an Agreement in Principle to establish a conservation easement along three miles of river frontage of the Yuba River downstream of the Parks Bar Bridge (YubaNet 2008). The easement area, consisting of approximately 180 ac of land owned by Western Aggregates, will be used by the four signatories for habitat restoration for salmon, trout, and other native Yuba River species.

The conservation easement will prohibit development or mining on the encumbered lands (except for disturbance that may be necessary for habitat restoration), and will outline a range of potential prescriptions for habitat restoration (YubaNet 2008). The project also will incorporate pedestrian access to the lower Yuba River through several walk-through gates to be established at locations to be agreed upon at a future date.

The parties plan to implement the project in three phases. Initially, the project will protect and conserve land from vehicular damage to habitat. Concurrently, SYRCL will lead design and feasibility studies for physical habitat restoration. In the second phase, habitat for salmon and riparian wildlife will be restored through a series of projects over the encumbered lands. Finally, the project contemplates implementing long-term enhancement and monitoring of these restored habitats. The timing of the completion of the three phases is unknown at this time because of the funding needs of the project (YubaNet 2008). Western initiated a Yuba Salmon Enhancement Fund through a "challenge grant" to SYRCL of $50,000, and Western agreed to match SYRCL's fund-raising of the project dollar-for-dollar for the first $50,000 raised by SYRCL (YubaNet 2008). The four parties to the Agreement in Principle also must obtain the consent of certain third parties who have varying interests in some of the lands contemplated for the conservation easement (YubaNet 2008).

On April 9, 2015, the SMGB approved the Amended Reclamation Plan for Western Aggregates Yuba County Operations (SMGB 2015a). Western Aggregates plans to remove aggregates (estimated to be up to 414 million tons) to an initial depth of -20 feet below msl (approximately 100 feet below the average pond surface level) over an approximately 1,960-ac area (of the 3,900 Vested Rights Area), during a phased 45-year surface mining operation, creating a series of five open-water ponds bordered by vegetation and dikes or berms (SMGB 2015b; SMGB 2014). Aggregate operations are anticipated to occur in three 15-year phases. During the life of the Amended Reclamation Plan, it is estimated that the average number of acres on which surface

mining operations would occur during any one year will be approximately 35 ac (SMGB 2014). After completion of reclamation activities, a relatively flat land contour with five large lakes would remain (Figure 8.4-17).

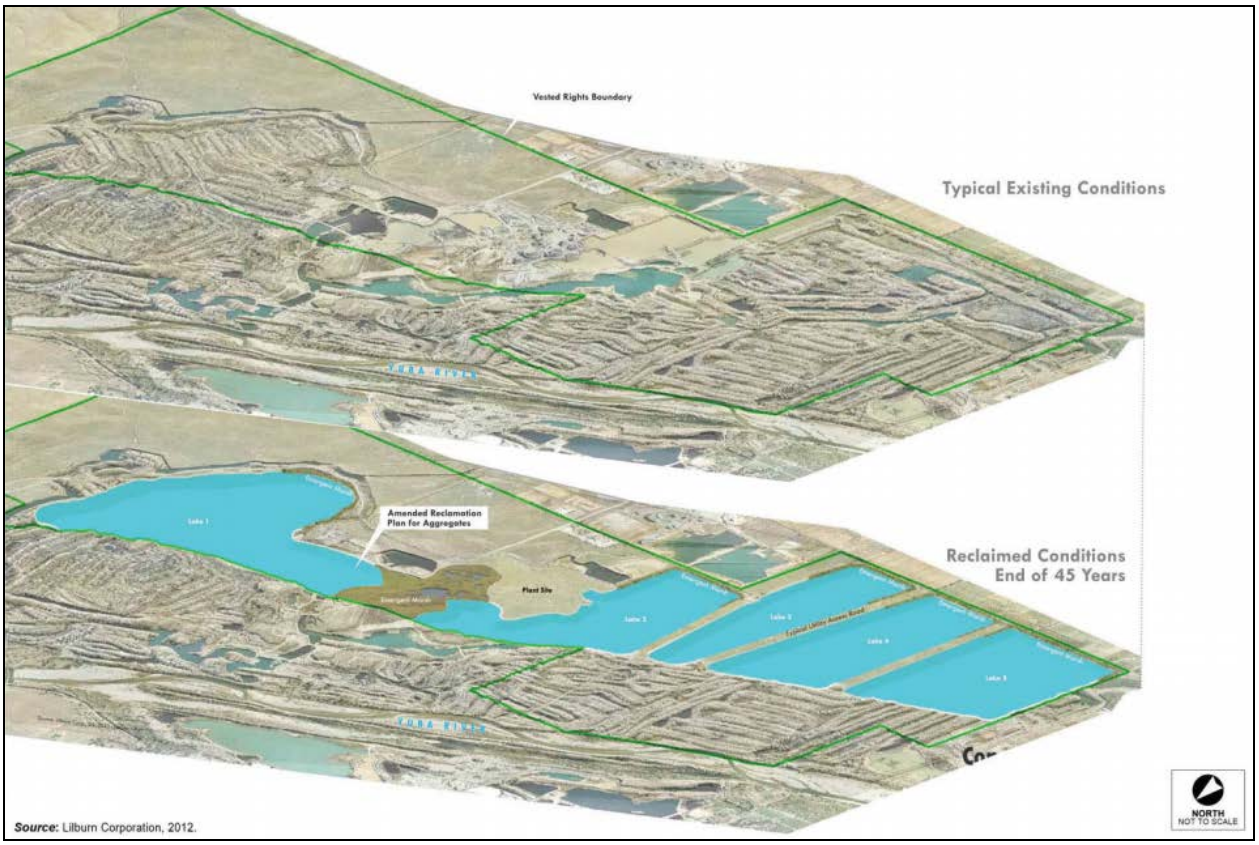

Figure 8.4-17. Conceptual simulation reclaimed areas in the Yuba Goldfields resulting from implemention of Western Aggregate's Amended Reclamation Plan (SMGB 2014).

Volunteer riparian growth has been found to establish within 6 to 8 months of inactivity around the circumference of ponds in the Yuba Goldfields (SMGB 2014). According to the Amended Reclamation Plan, *"(a)reas above the water table which are revegetated should not require follow-up monitoring based upon the demonstrated success of revegetation completed on the subject property by Cal Sierra Development, Inc."* However, financial assurance for the Amended Reclamation Plan include funding the monitoring revegetation performance for 5 years following the conclusion of the reclamation phasing plan (SMGB 2014).

8.4.4.3.3 Knife River Construction (formerly Baldwin Contracting Company) Hallwood Aggregate Facility

The Baldwin Contracting Company, Incorporated and Springer Family Trust proposed to expand its aggregate mining operations in the Hallwood area of east-central Yuba County, just west of the Yuba Goldfields off SR 20 (Placer County 2007). Baldwin Contracting conducted mining operations on 275 ac and was planning a phased expansion of about 200 ac over a period of 14 to

20 years, with expansion occurring 30 ac at a time. The expansion would have resulted in mining of an additional 500,000 t/y to 1 mty. Applications were submitted to Yuba County for a change of zone, a General Plan amendment, and a Yuba County surface mining permit, and to the California State Office of Mines and Geology for a permit amendment (Placer County 2007). The existing excavation area in the Yuba Goldfields was previously mined for aggregate and gold, and the proposed expansion area is currently in fruit orchards and has not been mined (California RWQCB 2010). Aggregate reserves exist to a depth of approximately 75 ft in both areas (California RWQCB 2010). A Report of Waste Discharge was submitted to the Central Valley Regional Water Quality Control Board for expansion of an existing aggregate facility, which was approved in 2010.

Currently, Knife River Construction (formerly Baldwin Contracting Company) conducts aggregate mining and reclamation operations on a site encompassing approximately 400 ac located adjacent to SR 20 in unincorporated Yuba County, approximately 3 miles northeast of Marysville. The Knife River Hallwood site is adjacent to (and north and west of) the Teichert Hallwood site. Based on information provided by the SMGB,[2] reclamation of the Knife River Hallwood site would occur under Reclamation Plan (RP) 92-01, which was clarified in 1999 via a minor amendment submitted to Yuba County by the operator (*Clarification of Reclamation Plan #92-01 for Baldwin Hallwood Mine [CID #91-58-0002], Yuba County, California, October 1999*). Implementation of the reclamation plan would create a series of open ponds with vegetated shorelines with a combined acreage of about 203 ac (SMGB 2014).

8.4.4.3.4 Dantoni Property

The Dantoni Property mining and reclamation operations, formerly referred to as Trinco Rock and Asphalt, is an active mining operation run by Kino Aggregates, Inc (SMGB 2013), located approximately 6 miles east of Marysville in unincorporated Yuba County. The project site is situated immediately west of the western boundary of the Western Aggregates operations along the south bank of the Yuba River. The Dantoni Property encompasses approximately 197 ac (SMGB 2014). Aggregate mining, processing, and reclamation operations are ongoing. Excavation below 60 feet below grade would be accomplished using a bucket line dredge, suction cutter dredge, or other excavation equipment. The maximum depth of surface mining operations would be approximately 40 feet below average groundwater levels, but it is predicted that excavation would not be able to exceed a depth of minus 100 feet mean sea level. Wet mining operations would create areas of open water in several areas of the project site. A total of approximately 180 ac of the 197-ac site would be mined and reclaimed within the 40-year projected planning period. Reclamation of the project site will create open water ponds with vegetated shorelines. A 10- to 60-foot-wide band of riparian vegetation would surround the northern perimeter of the lake. Mining operations within the 2006 reclamation plan boundary are proposed to be terminated approximately 40 years from approval of the reclamation plan (near 2046/2047) (SMGB 2014).

[2] W. Arcand, personal communication by State Mining and Geology Board with R. Hanson, Atkins (January 14, 2014).

8.4.4.3.5 Cal Sierra Development

Gold mining operations on the Western Aggregates site are conducted by a separate company called Cal Sierra Development, Inc. ("Cal Sierra") and typically occur concurrently with Western Aggregate's operations on the same Yuba Goldfields property (SMGB 2014). Seven ponds comprise Cal Sierra's areas of dredging operations, and the ponds are demarcated by Cal Sierra as Pond No. 1 through Pond No. 6, and the most recent Working Pond. Most of the Cal Sierra site has been dredged at least twice, and in some parts of the property three to four phases of dredging has occurred, each time to a greater depth with larger and/or more efficient recovery equipment (SMGB 2015c). Cal Sierra shares its currently approved Reclamation Plan (RP 80-01) with Western Aggregates, although Western Aggregates has recently received approval of an amended reclamation plan reflective of their vested rights area for aggregate minerals (SMGB 2015c). RP 80-01 covers approximately 2,000 ac, all of which apply to Cal Sierra's gold operations. Historically, Cal Sierra used bucket-line dredges that harvested materials from a depth of over 120 feet below water elevation, separated the fines and precious metals from the ore, and deposited the cobble tailings in their wake via a stacker or monitor. Western Aggregates retrieved those tailings from the conveyor stockpile and transported them via truck to their aggregate plant for processing. Areas dredged by Cal Sierra that are not incorporated in the Western Aggregates Amended Reclamation Plan will be reclaimed under RP 80-01 and will consist primarily of recontoured and revegetated dredger tailings (SMGB 2014).

8.4.4.4 Yuba County General Plan Update

The Yuba County General Plan Update Final EIR, in part, evaluated cumulative biological impacts in 2030 associated with implementing the general plan (Yuba County 2011). The cumulative effects assessment stated that past development in Yuba County, ranging from conversion of land to agricultural production to recent expansion of urban development, has resulted in a substantial loss of native habitat to other uses. This land conversion has benefited a few species, such as those adapted to agricultural, urban, and rural-scale developed uses, but the overall effect on native plants, animals, and habitat has been negative. Although many future projects and plans included in the cumulative scope of this analysis would be required to mitigate those impacts, in compliance with the CEQA, federal ESA, California ESA, and other State, local, and Federal statutes, many types of habitats and species are provided no protection. Therefore, it can be expected that the net loss of native habitat for plants and wildlife, agricultural lands, and open space areas that support important biological resources in Yuba County and related areas will continue (Yuba County 2011). The cumulative loss of habitat for special status species, such as habitat for riparian and aquatic species (e.g., California red-legged frog, giant garter snake, and western yellow-billed cuckoo) have already resulted in drastic declines in numbers of these species (Yuba County 2011). The evaluation focused on terrestrial species and their habitats.

In Yuba County, most established riparian vegetation occurs along the largest rivers; the Feather River, Yuba River, and Bear River, and south Honcut Creek. Important riparian corridors also occur along Dry Creek and other tributaries to Honcut Creek and the Yuba River. Riparian vegetation is present in the surrounding region along the Sacramento River and in the Sutter Bypass. Agricultural, residential, and industrial water use and land development have resulted in

a significant cumulative reduction in the extent of riparian habitats in the County and surrounding region. Implementing Action NR 5.3, which requires private and public projects to provide setbacks to protect riparian habitat as a condition of project approvals, is expected to substantially reduce impacts on riparian habitats, although complete avoidance may not be possible while still allowing full build out of the designated land uses. Therefore, the 2030 General Plan would have a cumulatively considerable contribution to this significant cumulative impact.

The County anticipates that implementation of the Yuba-Sutter Regional Conservation Plan (YSRCP) would reduce cumulative biological resources impacts. The YSRCP is both a federal Habitat Conservation Plan (HCP) and a state Natural Community Conservation Plan (NCCP). The YSRCP will provide an opportunity to mitigate potential impacts to biological resources that may occur through implementation of the General Plan. The YSRCP will also provide comprehensive species and ecosystem conservation, and contribute to the recovery of threatened and endangered species in Northern California (Sutter County 2014). A Notice of Preparation was issued in late 2014, followed by public scoping meetings for the YSRCP during early 2015. The YSRCP is still in draft form and an EIR is under preparation, but the County anticipates that it will be finalized and adopted before the 2030 General Plan is fully implemented.

8.4.4.5 Yuba-Sutter Regional Conservation Plan

According to Yuba County et al. (2011), the Yuba-Sutter Regional NCCP/HCP (currently referred to as the YSRCP) will address actions associated with future urban development, irrigation improvements, local flood control projects, and road improvements within Yuba and Sutter counties. During the early planning stages, a group of independent science advisors provided recommendations in a document titled Report of Independent Science Advisors for the Yuba and Sutter County NCCP/HCP (Conservation Biology Institute 2006).

Fish species to be considered in the YSRCP include spring-run Chinook salmon, fall-run Chinook salmon, steelhead, green sturgeon, white sturgeon, Sacramento splittail and Pacific lamprey (Conservation Biology Institute 2006). The reach of the lower Yuba River extending through and somewhat beyond the Yuba Goldfields was identified as having important Chinook salmon spawning habitat worthy of special attention in conservation, restoration, and enhancement measures. Fisheries-related recommendations included the need for additional information on the known distribution of fish species in local streams and associating these to the degree possible with information on flow regimes, known or suspected barriers, and other habitat quality variables (e.g., presence or absence of nonnative aquatic species; width and quality of riparian vegetation). This information would be used to identify potential actions that could aid in the recovery of local fish populations by removing physical passage barriers, removing water contaminants, altering the timing, duration, or magnitude of stream flows, or restoring riparian vegetation and/or adjacent upland buffering (Conservation Biology Institute 2006).

8.4.4.6 City of Wheatland, Reclamation District 2103, and Reclamation District 817 External Flood Source Flood Protection Projects

Four levee improvement alternatives have been identified as part of this project to mitigate the flooding issues associated with the City of Wheatland General Plan Area. The fourth alternative is the Reclamation District 2103 Bear River Levee Remediation, which is sponsored by local land developers and is designed to provide 200-year protection for the upper portion of the Bear River levee. This project would provide additional flood protection and management for the Upper Bear River and the City of Wheatland.

8.4.4.7 Trust for Public Land - Yuba River Acquisitions Plan

This project represents an historic opportunity to acquire three priority conservation areas along the Yuba River. The acquisition of these properties will help ensure the security of water quality in the Yuba River, protect threatened and endangered fisheries, create new recreational opportunities, and increase public access. These properties are part of the Yuba River Wildlife Area Conservation Conceptual Area Protection Plan (CAPP), which coordinates Cal Fish and Wildlife's acquisition and management activities on more than 81,000 ac of the Yuba River corridor.

Retain Flood Control Options: Protection of the project properties will increase long-term flood control options by protecting critical watershed lands in the river corridor and ensuring ownership and management patterns below and upstream of major water supply, power generation, and flood control facilities.

Restore and Protect Salmon and Steelhead Habitat: The project will protect, preserve and restore riparian and aquatic habitat for State and Federally listed Chinook salmon and steelhead trout and implement important conservation elements of the Yuba River CAPP, and the Yuba River Conservancy.

Create Habitat Connectivity: This project will provide tremendous opportunities for habitat connectivity, including:

- East-West connectivity along the Yuba River. The properties included in this project will provide protection for up to 14.5 mi of Yuba River through a 21-mi corridor.
- Downstream river connectivity. This project will provide valuable river corridor connectivity between Englebright Dam and Parks Bar necessary for the restoration of existing salmon and steelhead.
- Blue oak woodland corridor. The project will protect crucial properties in the center of a roughly twenty-mile north–south oak woodland corridor that stretches from the Cal Fish and Wildlife Daugherty Wildlife Area to the Spenceville Wildlife Area and Beale Air Force Base.

Protect Agricultural Lands: The project will preserve and protect important agricultural lands, including grassland and rangelands along the river corridor that provide important wildlife habitat, riparian zones and protect sensitive aquatic environments.

8.4.5 Other Activities Outside of the Yuba River Basin

As demonstrated in Section 4.0 of this Applicant-Prepared Draft BA, analyses were undertaken to confirm the downstream extent of the Action Area as the lower Yuba River confluence with the Feather River. However, areas downstream of the lower Yuba River (i.e., lower Feather River, lower Sacramento River, and the Bay-Delta) are considered within the context of cumulative effects.

Lower Yuba River populations of spring-run Chinook salmon and steelhead spend variable amounts of time in the lower Yuba River prior to migrating downstream through the lower Feather River, the lower Sacramento River, the Delta, and San Francisco Bay to the Pacific Ocean. Following their ocean residency, these fish then undertake an upstream migration through this same system prior to returning to the lower Yuba River to spawn. Spring-run Chinook salmon and steelhead populations are exposed and subject to myriad limiting factors, threats and stressors over the course of their journeys outside of the lower Yuba River.

According to NMFS (2014a), 63 out-of-basin stressors affect all identified lifestages of the lower Yuba River populations of spring-run Chinook salmon and steelhead (see Section 5.0 of this Applicant-Prepared Draft BA. Many of the most important stressors specific to the steelhead DPS correspond to the stressors described for the spring-run Chinook salmon ESU. As previously stated, the 2009 NMFS OCAP BO (2009b) identified factors leading to the current status of the spring-run Chinook salmon ESU, which also are applicable to the steelhead DPS, including habitat blockage, water development and diversion dams, water conveyance and flood control, land use activities, water quality, hatchery operations and practices, over-utilization (e.g., ocean commercial and sport harvest, inland sport harvest), disease and predation, environmental variation (e.g., natural environmental cycles, ocean productivity, climate change), and non-native invasive species. The previous discussions in this Applicant-Prepared Draft BA addressing limiting factors and threats for the spring-run Chinook salmon ESU, the Central Valley steelhead DPS, and their specific geographic influences including the Sacramento River and the Delta, are not repeated in this section of this Applicant-Prepared Draft BA.

Green sturgeon access to historical spawning habitat has been reduced by construction of migration barriers, such as major dams, that block or impede access to the spawning habitat. The principal factor for the decline of green sturgeon reportedly comes from the reduction of green sturgeon spawning habitat to a limited area of the Sacramento River (70 FR 17391). Other stressors identified to the Southern DPS of North American green sturgeon include alteration of habitat (including changes in flows and water temperatures), delayed or blocked migration, impaired water quality, dredging and ship traffic, over-harvest, disease and predation, inadequacy of existing regulatory mechanisms, non-native invasive species, and entrainment.

Many of the out-of-basin stressors affecting listed species considered in this Applicant-Prepared Draft BA emanate from other federal actions that have already undergone ESA consultation (e.g., CVP/SWP continued operations), which were incorporated and evaluated as part of the Environmental Baseline. Additionally, there are large-scale water management-related projects potentially affecting listed species and their critical habitats that are not included in the Effects Assessment (including cumulative effects) for this Proposed Action. Of particular note are the on-going re-consultation for the Long-term Operations of the Central Valley Project and State Water Project, and the proposed California WaterFix initiative – both of which are undergoing ESA consultation separate from the Proposed Action.

Effects of other non-federal activities outside of the Yuba River Basin which are reasonably certain to occur are not described in detail for the cumulative effects analysis presented in this Applicant-Prepared Draft BA. Any such effects are anticipated to be minor in comparison to the on-going federal intiatives listed above, and the Proposed Action would not result in flow, water temperature or other changes downstream of the lower Yuba River confluence with the Feather River.