Pacific Lamprey

Construction and Maintenance of Water Conveyance Facilities

Impact AQUA-163: Effects of Construction of Water Conveyance Facilities on Pacific Lamprey

The potential effects of construction of the water conveyance facilities on Pacific lamprey would be the same as those described for Alternative 4, Impact AQUA-163. This section provides additional detail on underwater noise impacts which are also applicable to Impact AQUA-163 in Alternative 4.

Table 11-8 presents the life stages of Pacific lamprey and months of their potential presence in the north, east, and south Delta during the proposed in-water construction window (June 1–October 31). Potential impacts of pile driving noise on Pacific lamprey are different from other fish species. In a study of hearing in sturgeon and lamprey, Popper (2005) found that lamprey do not have the typical hearing structures of other fish. Although there have been no studies to determine responses of lamprey to sound (Popper 2005), ammocoetes are partially buried in the substrate, and the substrate dampens vibrations and noise. As a result, at least some life stages of Pacific lamprey may be less susceptible to injury from impact pile driving than other fish species.

Under Alternative 4A, adult, ammocoete, and macropthalmia life stages could be present in the vicinity of the proposed in-water pile driving locations (intakes, barge unloading facilities, CCF cofferdams, CCF siphons, and Head of Old River operable barrier) during in-water pile driving activities. While adults would primarily occur between June and July and macropthalmia in June, ammocoetes would occur throughout the year. However, the abundance of ammocoetes is low at all in-water pile driving sites. Adults are considered moderately abundant in June and July near the intakes, but of low abundance in the east and south Delta where barge landings would be located. Macropthalmia would be primarily migrating downstream, and during only a portion of the in-water construction period. Therefore their exposure to pile driving sound levels would likely be limited.

Given the likely low numbers in the east and south Delta, the relatively small areas affected by underwater noise in the east and south Delta, and the intermittent nature of pile driving activities, exposure of Pacific lamprey to potentially harmful pile driving noise is expected to be limited to a small proportion of the total population. Implementation of Mitigation Measures AQUA-1a and AQUA-1b would reduce the magnitude of these effects. Overall, underwater construction noise would be expected to adversely affect small numbers of Pacific lamprey and not result in significant population-level effects.

NEPA Effects: As concluded for Alternative 4, Impact AQUA-163, the effect would not be adverse for Pacific lamprey. Implementation of the measures described in Appendix 3B, *Environmental Commitments*, such as *Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue and Salvage Plan*; and *Barge Operations Plan* would guide rapid and effective response in the case of inadvertent spills of hazardous materials. This species' natural tolerance to turbidity, would likely avoid the risk of any adverse turbidity effects resulting from project construction. Construction would not be expected to increase predation rates relative to baseline conditions. Construction will result in both temporary and permanent alteration of rearing and migratory habitats used by Pacific lamprey. However, Alternative 4A includes Environmental Commitment 4 to restore tidal habitat. The direct effects of underwater construction noise on Pacific lamprey that may be present could be adverse if they are exposed. However, implementation of Mitigation Measures AQUA-1a and AQUA-

1b, combined with the in-water work window that would minimize exposure, would reduce the potential for effects from underwater noise and this effect would not be adverse.

CEQA Conclusion: As described in Alternative 4, Impact AQUA-163, the impact of the construction of the water conveyance facilities on Pacific lamprey would not be significant except for construction noise associated with pile driving. Construction of Alternative 4A involves several elements with the potential to affect Pacific lamprey. However, these turbidity and hazardous material spill effects will be effectively avoided and/or minimized through implementation of environmental commitments (see Impact AQUA-1 and Appendix 3B, *Environmental Commitments*: *Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue and Salvage Plan*; and *Barge Operations Plan*). Implementation of Mitigation Measures AQUA-1a and AQUA-1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Impact AQUA-164: Effects of Maintenance of Water Conveyance Facilities on Pacific Lamprey

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 4A would be the same as those described for Alternative 4, Impact AQUA-164. As concluded in Alternative 4, Impact AQUA-164, the impact would not be adverse for Pacific lamprey.

CEQA Conclusion: As described in Alternative 4, Impact AQUA-164, the impact of the maintenance of water conveyance facilities on Pacific lamprey would be less than significant and no mitigation is required.

Operations of Water Conveyance Facilities

Impact AQUA-165: Effects of Water Operations on Entrainment of Pacific Lamprey

Water Exports

The potential entrainment impacts of Alternative 4A on Pacific lamprey and river lamprey would be similar to Alternative 4 for operating SWP/CVP south Delta export facilities and the proposed new SWP/CVP North Delta intakes (Impact AQUA-165). Alternative 4A operational criteria are designed to avoid or reduce potential entrainment and the effect would not be adverse.

The analysis of Pacific lamprey and river lamprey entrainment at the SWP/CVP south Delta export facilities is combined because the salvage facilities do not distinguish between the two lamprey species. Under Scenario H3_ELT, average annual entrainment of lamprey at the south Delta export facilities would be substantially reduced by about 45% (Table 11-4A-115) across all year types compared to the NAA_ELT. Entrainment losses would be further reduced under Scenario H4_ELT compared to NAA_ELT. Therefore, Alternative 4A would not have adverse effects on lamprey.

Predation Associated with Entrainment

Entrainment-related predation loss of lamprey at the south Delta facilities would not be greater under this Alternative compared to the NNA-ELT and would be lower due to a reduction in entrainment loss. Conditions under Scenario H4_ELT would decrease predation loss relative to NAA_ELT and Scenario H3_ELT. Predation at the north Delta would be increased due to the installation of the proposed water export facilities on the Sacramento River. The effect on lamprey from predation loss at the north Delta facilities is unknown because of the lack of knowledge about their distribution and population abundances in the Delta.

NEPA Effects: Overall, the effect of entrainment and entrainment-related predation would not be adverse because entrainment, and predation associated with entrainment, would be reduced under Alternative 4A.

CEQA Conclusion: Annual entrainment losses of lamprey would be decreased under Scenario H3_ELT by 45% relative to Existing Conditions, and would be further decreased under Scenario H4_ELT. Lamprey predation loss at the south Delta facilities would not be increased relative to Existing Conditions and may be decreased due to reduction entrainment losses. Predation at the north Delta would be increased due to the installation of the proposed water export facilities on the Sacramento River. The effect on lamprey from predation loss at the north Delta facilities is unknown because of the lack of knowledge about their distribution and population abundances in the Delta. Overall, the effect of predation loss on lamprey under Alternative 4A would be similar or lower than existing conditions, consistent with the change in entrainment. Overall, the impacts of Alternative 4A water operations to Pacific lamprey are considered less than significant because they would reduce entrainment and potentially entrainment-related predation. Consequently, no mitigation would be required.

Table 11-4A-115. Lamprey Annual Entrainment Index[a] at the SWP and CVP Salvage Facilities for Alternative 4A (Scenario H3_ELT)

	Absolute Difference (Percent Difference)	
Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
All Years	-1,526 (-45%)	-1,504 (-45%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

[a] Estimated annual number of fish lost, based on non-normalized data.

Impact AQUA-166: Effects of Water Operations on Spawning and Egg Incubation Habitat for Pacific Lamprey

In general, Alternative 4A would not affect the quality and quantity of spawning and egg incubation habitat for Pacific lamprey relative to the NAA_ELT.

H3_ELT/ESO_ELT

Flow-related impacts to Pacific lamprey spawning habitat were evaluated by estimating effects of flow alterations on egg exposure, called redd dewatering risk, and effects on water temperature. Rapid reductions in flow can dewater redds leading to mortality. Locations for each river used in the dewatering risk analysis were based on available literature, personal conversations with agency experts, and spatial limitations of the CALSIM II model, and include the Sacramento River at Keswick, Sacramento River at Red Bluff, Trinity River downstream of Lewiston, Feather River at Thermalito Afterbay, and the American River at Nimbus Dam and at the confluence with the Sacramento River. Pacific lamprey spawn in these rivers between January and August so flow reductions during those months have the potential to dewater redds, which could result in incomplete development of the eggs to ammocoetes (the larval stage). Water temperature results from the SRWQM and the Reclamation Temperature Model were used to assess the exceedances of water temperatures under all model scenarios in the upper Sacramento, Trinity, Feather, and American rivers.

Dewatering risk to redd cohorts was characterized by the number of cohorts experiencing a month-over-month reduction in flows (using CALSIM II outputs) of greater than 50%. Small-scale spawning location suitability characteristics (e.g., depth, velocity, and substrate) of river lamprey are not adequately described to employ a more formal analysis such as a weighted usable area analysis. Therefore, there is uncertainty that these values represent actual redd dewatering events, and results should be treated as rough estimates of flow fluctuations under each model scenario. Results were expressed as the number of cohorts exposed to dewatering risk and as a percentage of the total number of cohorts anticipated in the river based on the applicable time-frame, January to August.

There would be minimal differences between H3_ELT and NAA_ELT in exposure to flow reductions in all rivers except for a small (10%) increase in the Feather River at Thermalito Afterbay (Table 11-4A-116). These results indicate that H3_ELT would not have biologically meaningful effects on Pacific lamprey redd cohorts in all locations analyzed because the difference represents only 2 percent (11 out of 656) of total hypothetical redd cohorts.

Table 11-4A-116. Differences between Model Scenarios in Dewatering Risk of Pacific Lamprey Redd Cohorts[a]

Location	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Sacramento River at Keswick	13 (24%)	1 (-2%)
Sacramento River at Red Bluff	15 (28%)	5 (8%)
Trinity River downstream of Lewiston	-1 (-1%)	1 (1%)
Feather River at Thermalito Afterbay	-26 (-17%)	11 (10%)
American River at Nimbus Dam	27 (32%)	5 (5%)
American River at Sacramento River Confluence	31 (33%)	8 (7%)

[a] Difference and percent difference between model scenarios in the number of Pacific lamprey redd cohorts experiencing a month-over-month reduction in flows of greater than 50%. Positive values indicate a higher value in H3_ELT than in Existing Conditions or NAA_ELT.

Significant reduction in survival of eggs and embryos of Pacific lamprey were observed at 22°C (71.6°F; Meeuwig et al. 2005). Therefore, in the Sacramento River, this analysis predicted the number of consecutive 49 day periods for the entire 82-year CALSIM period during which at least one day exceeds 22°C (71.6°F) using daily data from SRWQM. For other rivers, the analysis predicted the number of consecutive 2 month periods during which at least one month exceeds 22°C (71.6°F) using monthly averaged data from the Reclamation temperature model. Each individual day or month starts a new "egg cohort" such that there are 19,928 cohorts for the Sacramento River, corresponding to 82 years of eggs being laid every day each year from January 1 through August 31, and 648 cohorts for the other rivers using monthly data over the same period. The incubation periods used in this analysis are conservative and represent the extreme long end of the egg incubation period (Brumo 2006). Also, the utility of the monthly average time step is limited because the extreme temperatures are masked; however, no better analytical tools are currently available for this analysis. Exact spawning locations of Pacific lamprey are not well defined. Therefore, this analysis uses the widest range in which the species is thought to spawn in each river.

In most locations, egg cohort exposure would not differ between NAA_ELT and H3_ELT (Table 11-4A-117). However, the number of cohorts exposed under H3_ELT would be 92% lower than those under NAA_ELT in the Trinity River at Lewiston. Also, the number of cohorts exposed under H3_ELT would be 93% greater than those under NAA_ELT in the Feather River below Thermalito Afterbay. Although a 92% reduction and a 93% increase appear substantial, these values represent only 23 and 37 egg cohorts, respectfully, or 3.5% and 5.7% of the 648 total hypothetical cohorts. Therefore, these increases and decreases in egg cohort exposure are small relative to the total population. As a result, they would not have a biologically meaningful effect.

Table 11-4A-117. Differences (Percent Differences) between Model Scenarios in Pacific Lamprey Egg Cohort Temperature Exposure[a]

Location	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Sacramento River at Keswick	0 (NA)	0 (NA)
Sacramento River at Hamilton City	506 (NA)	23 (5%)
Trinity River at Lewiston	0 (0%)	-23 (-92%)
Trinity River at North Fork	0 (NA)	0 (0%)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	53 (221%)	37 (93%)
American River at Nimbus	42 (382%)	2 (4%)
American River at Sacramento River Confluence	96 (171%)	2 (1%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	23 (1150%)	0 (0%)

NA = could not be calculated because the denominator was 0.

[a] Difference and percent difference between model scenarios in the number of Pacific lamprey egg cohorts experiencing water temperatures above 71.6°F during January to August on at least one day during a 49-day incubation period in the Sacramento River or for at least one month during a 2-month incubation period for in other rivers each model scenario. Positive values indicate a higher value in H3_ELT than in EXISTING CONDITIONS or NAA_ELT.

H4_ELT/HOS

Flows during January through August under H4_ELT would generally be similar to or greater than flows under H3_ELT in all rivers except the Feather River. As a result, the redd dewatering risk analysis was not conducted for H4_ELT in these rivers and results for H4_ELT would be the same as those for H3_ELT.

In the Feather River at Thermalito Afterbay, there would be 23 more cohorts (20%) exposed to a 50% month over month drop in flow rate under H4_ELT relative to NAA_ELT (Table 11-4A-118). Although relatively large, this value represents <4% of the population of ammocoetes (23 out of 648 total cohorts). Therefore, it is not expected that this increase in exposure would have a biologically meaningful effect to the population.

Table 11-4A-118. Differences between Model Scenarios in Dewatering Risk of Pacific Lamprey Redd Cohorts in the Feather River at Thermalito Afterbay[a]

Measurement	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Difference (Percent Difference)	-14 (-9%)	23 (20%)

[a] Difference and percent difference between model scenarios in the number of Pacific lamprey redd cohorts experiencing a month-over-month reduction in flows of greater than 50%. Positive values indicate a higher value in H4 than in Existing Conditions or NAA_ELT.

Water temperatures would not differ between H4_ELT and H3_ELT and, therefore, no egg cohort temperature analyses were conducted. Overall, results for H4_ELT would be similar to those for H3_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect is not adverse because Alternative 4A would not have substantial effects on spawning and egg incubation habitat for Pacific lamprey. There would be no biologically meaningful differences in flow reductions that increase redd dewatering risk between the NAA_ELT and H3_ELT at all locations evaluated. Also, there would be increases and decreases in exposure risk of eggs to elevated temperatures but would not have a biologically meaningful effect due to their small absolute values relative to total egg cohort sizes. These modeling results are consistent between H3_ELT and H4_ELT.

CEQA Conclusion: Collectively, the results of the Impact AQUA-166 CEQA analysis show that there would be no effect of Alternative 4A on Pacific lamprey spawning and egg incubation habitat relative to the CEQA baseline.

H3_ELT/ESO_ELT

Effects of H3_ELT on month-over-month flow reduction compared to Existing Conditions consist of negligible effects (<5% difference) in the Trinity River, a decrease in egg cohorts exposed to flow reductions (-17%) in the Feather River, and moderate to substantial increases in exposures in the Sacramento River and American River (Table 11-4A-116). Changes would be most substantial for the American River (increased risk of dewatering exposure to 27 cohorts or 32% at Nimbus Dam, and 31 cohorts or 33% at the confluence). In the Sacramento River, there would be increased exposure to flow reductions for 13 cohorts or 24% at Keswick, and to 15 cohorts or 28% at Red Bluff. These results indicate that effects of Alternative 4A on flow would not negatively affect Pacific lamprey redd dewatering risk in the Feather River and Trinity River. Further, an increase of 13 to 31 cohorts out of 656 cohorts would represent fewer than 5 percent of total redd cohorts. Therefore, Alternative 4A would not affect dewatering risk in the Sacramento River or the American River.

The number of egg cohorts exposed to 22°C (71.6°F) under H3_ELT would be greater than that under Existing Conditions in at least one location in all rivers, except the Trinity River (Table 11-4A-117). In the American River, the difference in the number of cohorts exposed would represent 6 to 15 percent of total cohorts.

H4_ELT/HOS

Flows during January through August under H4_ELT would generally be similar to or greater than flows under H3_ELT in all rivers except the Feather River. As a result, the redd dewatering risk analysis was not conducted for H4_ELT in these rivers and results for H4_ELT would be the same as those for H3_ELT.

In the Feather River at Thermalito Afterbay, there would be 14 fewer cohorts (9%) exposed to a 50% month over month drop in flow rate under H1 relative to NAA_ELT (Table 11-4A-118). Although relatively large, this value represents <5% of the population of ammocoetes. Therefore, it is not expected that this decrease in exposure would have a biologically meaningful effect to the population.

Water temperatures under H4_ELT would be similar to those under H3_ELT for all rivers examined. Therefore, no additional cohort temperature exposure analyses were conducted for H4_ELT. Overall, results for H4_ELT would be similar to those for H3_ELT.

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the impacts to Pacific lamprey spawning and egg incubation conditions would be less than significant. There would be no increases in exposure to redd dewatering that would affect more than 5 percent of the population in all rivers. Temperature exposure in the American River at the Sacramento River confluence would affect 15 percent more cohorts under H3_ELT, but there would be no other differences that would have a biologically meaningful effect to Pacific lamprey in any of the other 9 locations evaluated. Therefore, the impact is less than significant and no mitigation is required.

Impact AQUA-167: Effects of Water Operations on Rearing Habitat for Pacific Lamprey

In general, the effect of Alternative 4A on Pacific lamprey rearing habitat would be negligible relative to the NAA_ELT.

H3_ELT/ESO_ELT

Flow-related impacts to Pacific lamprey rearing habitat were evaluated by estimating of the frequency of rapid flow reductions in ammocoete rearing areas. Rapid reductions in flow can strand ammocoetes, leading to mortality. Comparisons of effects were made for ammocoete cohorts in the Sacramento River at Keswick and Red Bluff, the Trinity River, Feather River, and the American River at Nimbus Dam and at the confluence with the Sacramento River. An ammocoete remains relatively immobile in the sediment in the same location for 5 to 7 years, after which it migrates downstream. During the upstream rearing period there is potential for ammocoete stranding from rapid reductions in flow.

The analysis of ammocoete stranding was conducted by analyzing a range of month-over-month flow reductions from CALSIM II outputs, using the range of 50%–90% in 5% increments. A cohort of ammocoetes was assumed to be born every month during their spawning period (January through August) and spend 7 years rearing upstream. Therefore, a cohort was considered stranded if at least one month-over-month flow reduction was greater than a given flow reduction (50%–90% in 5% increments)at any time during the seven-year period.

Comparisons of month-over-month flow reductions for the Sacramento River at Keswick (Table 11-4A-119) indicate that H3_ELT would have either no effect (0%) or negligible effects (<5%) on cohort exposures to all flow reductions. These results indicate that there would be no difference in Pacific lamprey stranding risk between H3_ELT and NAA_ELT in the Sacramento River at Keswick.

Table 11-4A-119. Percent Difference between Model Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Sacramento River at Keswick

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	0	0
-60%	4	4
-65%	1	-2
-70%	0	-3
-75%	3	2
-80%	4	0
-85%	104	0
-90%	NA	NA

NA = could not be calculated because the denominator was 0.
[a] Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

Results of comparisons for the Sacramento River at Red Bluff (Table 11-4A-120) indicate that there would be no or negligible changes in flow reductions. These results indicate that there would no effect of H3_ELT on Pacific lamprey ammocoete exposure to flow reductions in the Sacramento River at Red Bluff.

Table 11-4A-120. Percent Difference between Model Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Sacramento River at Red Bluff

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	4	4
-60%	1	-1
-65%	-1	-2
-70%	3	0
-75%	10	0
-80%	23	0
-85%	0	0
-90%	NA	NA

NA = could not be calculated because the denominator was 0.
[a] Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

Comparisons for the Trinity River indicate that there would be no or small (5%) differences in cohort exposure between NAA_ELT and H3_ELT for all flow reductions evaluated (Table 11-4A-121). These results indicate that there would be no biologically meaningful effects of H3_ELT on Pacific lamprey stranding risk in the Trinity River.

Table 11-4A-121. Percent Difference between Model Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Trinity River at Lewiston

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	0	0
-60%	0	0
-65%	0	0
-70%	0	0
-75%	22	1
-80%	20	1
-85%	20	1
-90%	34	5

[a] Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

In the Feather River at Thermalito Afterbay, there would be no difference in ammocoete cohort exposure at the 50% through 75% flow reductions (Table 11-4A-122). For the 80% through 90% flow reductions, ammocoete exposure would be 1% to 64% lower, which would have a beneficial effect on ammocoete rearing. These results indicate that there will be beneficial effects of H3_ELT on Pacific lamprey ammocoete rearing in the Feather River.

Table 11-4A-122. Percent Difference between Model Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Feather River at Thermalito Afterbay

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	0	0
-60%	0	0
-65%	0	0
-70%	0	0
-75%	0	0
-80%	-3	-1
-85%	-19	-30
-90%	-64	-64

[a] Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

Comparisons for the American River at Nimbus Dam (Table 11-4A-123) and at the confluence with the Sacramento River (Table 11-4A-124) have similar results. There would be no or negligible differences in cohort exposure between NAA_ELT and H3_ELT for the 50% to 70% flow reductions range and the 85% to 90% flow reductions range. There would be higher cohort exposure under H3_ELT relative to NAA_ELT at Nimbus Dam at the 75% flow reduction (7% higher) and at the confluence with the Sacramento River at the 75% (12% higher) and 80% (23% higher) flow reductions. At the confluence with the Sacramento River, there would be no differences in cohort exposure for all flow reduction levels except the 85% level, at which exposure would be 33% greater under H3_ELT. These results indicate that there would generally be no effect of H3_ELT on stranding risk in the American River with few small exceptions that would be infrequent and would therefore not result in biologically meaningful effects.

Table 11-4A-123. Percent Difference between Model Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, American River at Nimbus Dam

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	0	0
-60%	1	0
-65%	1	-1
-70%	34	4
-75%	85	12
-80%	238	23
-85%	104	0
-90%	-100	0

[a] Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

Table 11-4A-124. Percent Difference between Model Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, American River at the Confluence with the Sacramento River

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	0	0
-60%	1	0
-65%	1	1
-70%	7	1
-75%	22	4
-80%	192	4
-85%	223	33
-90%	104	0

[a] Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

To evaluate water temperature-related effects of H3_ELT on Pacific lamprey ammocoetes, we examined the predicted number of ammocoete "cohorts" that experience water temperatures greater than 71.6°F for at least one day in the Sacramento River (because daily water temperature data are available) or for at least one month in the Feather, American, Stanislaus, and Trinity rivers over a 7 year period, the maximum likely duration of the ammocoete life stage (Moyle 2002). Each individual day or month starts a new "cohort" such that there are 18,244 cohorts for the Sacramento River, corresponding to 82 years of ammocoetes being "born" every day each year from January 1 through August 31, and 593 cohorts for the other rivers using monthly data over the same period.

The number of ammocoete cohorts exposed to temperatures greater than 71.6°F would be similar between NAA_ELT and H3_ELT in most of the rivers (Table 11-1A-125). Ammocoetes in the Feather River at Thermalito Afterbay would experience a 15% increase in exposure to temperatures greater than 71.6°F, although there would be no difference relative to the NAA at the fish dam. Overall, the effects would be minimal to the Pacific lamprey population.

Table 11-4A-125. Differences (Percent Differences) between Model Scenarios in Pacific Lamprey Ammocoete Cohorts Exposed to Temperatures Greater than 71.6°F in at Least One Day or Month

Location	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Sacramento River at Keswick[b]	0 (NA)	0 (NA)
Sacramento River at Hamilton City[b]	7,721 (NA)	476 (7%)
Trinity River at Lewiston	56 (NA)	0 (0%)
Trinity River at North Fork	56 (NA)	0 (0%)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	164 (43%)	70 (15%)
American River at Nimbus	265 (137%)	-14 (-3%)
American River at Sacramento River Confluence	151 (35%)	9 (2%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	283 (505%)	0 (0%)

NA = could not be calculated because the denominator was 0.
[a] Positive values indicate a higher value in H3_ELT than in EXISTING CONDITIONS or NAA_ELT.
[b] Based on daily data; all other locations use monthly data; 1922–2003.

H4_ELT/HOS

There would be generally no differences in mean flows year-round between H4_ELT and H3_ELT in the Sacramento, Trinity, and American rivers. Therefore, ammocoete stranding risk analysis was conducted only for the Feather River.

In the Feather River at Thermalito Afterbay, there would be no or a negligible difference in ammocoete cohort exposure between NAA_ELT and H4_ELT at the 50% through 80% flow reductions (Table 11-4A-126). For the 85% and 90% flow reductions, ammocoete exposure under H4_ELT would be 9 and 53% higher, respectively. The 85% and 90% flow reductions would occur rarely: 19 and 7 times under NAA_ELT and 22 and 10 times, respectively under H4_ELT throughout the 985 total months evaluated. Therefore, these reductions would affect a small proportion of the population. As a result, these results indicate that there would be no biologically meaningful effect of H4_ELT on stranding risk.

Table 11-4A-126. Percent Difference between Baselines and H4_ELT Model Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Feather River at Thermalito Afterbay

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
-50%	0	0
-55%	0	0
-60%	0	0
-65%	0	0
-70%	0	0
-75%	0	0
-80%	0	2
-85%	25	9
-90%	53	53

[a] Negative values indicate reduced cohort exposure under H4_ELT.

There would generally be no differences in mean water temperatures year-round between H4_ELT and H3_ELT in any river examined. As a result, no additional ammocoete cohort exposure analyses were conducted for H4_ELT. Results of these analyses for H4_ELT would be the same as those for H3_ELT.

Overall, these results indicate that results for H4_ELT would generally be similar to those under H3_ELT except for an increase in ammocoete stranding risk exposure in the Feather River at 85% and 90% flow reductions under H4_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect is not adverse because it would not substantially reduce rearing habitat or substantially reduce the number of fish as a result of ammocoete mortality. There would generally be negligible effects or beneficial effects of H3_ELT on Pacific lamprey ammocoete stranding risk in all rivers evaluated. There would be minimal differences in exposure risk of ammocoetes to elevated temperatures within each river evaluated.

CEQA Conclusion: In general, Alternative 4A would reduce the quantity and quality of rearing habitat for Pacific lamprey relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, reviewing the alternative's impacts in relation to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demand. Informed by the NAA_ELT comparison, Alternative 4A would not affect the quantity and quality of rearing habitat for Pacific lamprey relative to NAA_ELT.

H3_ELT/ESO_ELT

Comparisons of H3_ELT to Existing Conditions for the Sacramento River at Keswick indicate negligible changes (<5%) in occurrence of flow reductions for all flow reduction categories, with the exception of a 104% increase in occurrence of month-over-month flow reductions of 85% (Table 11-4A-119). Comparisons for the Sacramento River at Red Bluff indicate no effect (0%) or negligible effects (<5%) for all flow reduction categories with the exception of 10% and 23% increases in exposure for the 75% and 80% flow reduction events, respectively (Table 11-4A-120). Based on the fact that increases in exposure would only be substantial for one or two flow reduction categories depending on location, H3_ELT would not be expected to have biologically meaningful negative effects on spawning success in the Sacramento River but would contribute incrementally to regional effects.

Increases from Existing Conditions to H3_ELT of 20–34% are predicted for egg cohort exposed to flow reductions from 75% to 90% for the Trinity River (Table 11-4A-121); the percentages correspond generally to increased occurrences from approximately 350 events for Existing Conditions to approximately 450 events for H3_ELT. Despite the prevalence of increased exposure risk to the higher flow reduction events, the percentage of cohorts exposed to stranding risk is relatively small compared to the total number of cohorts and therefore effects on rearing success in the Trinity River would not be biologically meaningful but would contribute incrementally to regional effects.

Comparisons for the Feather River at Thermalito Afterbay (Table 11-4A-122) indicate that there would be negligible (<5%) differences in exposure of Pacific lamprey ammocoete cohorts to all flow reductions except the 85% and 90% reductions, in which exposure would be 19% and 64% lower under H3_ELT. This suggests that flow conditions would improve for Pacific lamprey ammocoetes under H3_ELT.

Comparisons for the American River at Nimbus Dam (Table 11-4A-123) and at the confluence with the Sacramento River (Table 11-4A-124) indicate an increase in exposure risk to stranding between 70% and 85% or 90% for H3_ELT compared to Existing Conditions; predicted increases ranged from 34 to 238% for Nimbus Dam and from 7 to 223% for the confluence. These persistent and substantial increases in exposures to larger flow reduction events would have biologically meaningful effects on Pacific lamprey ammocoete cohort stranding and therefore spawning success in the American River.

The number of ammocoete cohorts exposed to 71.6°F under H3_ELT would be higher than those under Existing Conditions in most locations examined, except in the Sacramento River at Keswick, in the Feather River at the Fish Barrier Dam, and the Stanislaus River at Knights Ferry (Table 11-4A-125).

H4_ELT/HOS

There would be generally no differences in mean flows year-round between H4_ELT and H3_ELT in the Sacramento, Trinity, and American rivers. Therefore, ammocoete stranding risk analysis was conducted only for the Feather River.

In the Feather River at Thermalito Afterbay, there would be no or a negligible difference in ammocoete cohort exposure between Existing Conditions and H4_ELT at the 50% through 80% flow reductions (Table 11-4A-126). For the 85% and 90% flow reductions, ammocoete exposure under H4_ELT would be 25% and 53% higher, respectively. These results indicate that there would generally be no effect of H4_ELT on stranding risk with exceptions that very high flow reductions that would not be common enough to have biologically meaningful effects.

There would generally be no differences in mean water temperatures year-round between H4_ELT and H3_ELT in any river examined. As a result, no additional ammocoete cohort exposure analyses were conducted for H4_ELT. Results of these analyses for H4_ELT would be the same as those for H3_ELT.

Overall, these results indicate that results for H4_ELT would generally be similar to those under H3_ELT.

Summary of CEQA Conclusion

Under Alternative 4A, the risk of redd dewatering would increase to some degree under some flow reductions in the Sacramento and Trinity rivers, and substantially in the American River at Nimbus Dam (increases from 34% to 238%). Flow reductions would increase the risk of ammocoete stranding and desiccation in these rivers. There would be a beneficial effect from decreased occurrence of flow reduction events (=reduced ammocoete stranding risk) in the Feather River (-19% to -64% for the 85% and 90% flow reduction categories) but this effect would not offset the more substantial reductions in the other locations. There would be an increase in exposure to critical water temperatures in most locations examined. Increased exposure to higher water temperatures would increase stress and mortality of ammocoetes. Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce rearing habitat and substantially reduce the number of Pacific lamprey as a result of fry and juvenile mortality.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur in 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of the results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, there would generally be negligible effects or beneficial effects of Alternative 4A on Pacific lamprey ammocoete stranding risk in all rivers evaluated. There would be increase and decreases in exposure risk of ammocoetes to elevated temperatures within each river evaluated that would balance out such that there would be no net effect on Pacific lamprey ammocoetes. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in flows and water temperatures under Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions).

Impact AQUA-168: Effects of Water Operations on Migration Conditions for Pacific Lamprey

In general, the effect of Alternative 4A on Pacific lamprey migration conditions would be negligible relative to the NAA_ELT.

H3_ELT/ESO_ELT

After 5 to7 years, Pacific lamprey ammocoetes migrate downstream and become macropthalmia (juveniles) once they reach the Delta. Migration generally is associated with large flow pulses in winter months (December through March) (USFWS unpublished data) meaning alterations in flow have the potential to affect downstream migration conditions. The effects of H3_ELT water operations on seasonal migration flows for Pacific lamprey macropthalmia were assessed using CALSIM II flow output. Flow rates along the likely migration pathways of Pacific lamprey during the likely macropthalmia migration period (December through May) were examined for the Sacramento River at Rio Vista and Red Bluff, the Feather River at the confluence with the Sacramento River, and the American River at the confluence with the Sacramento River.

The adult Pacific lamprey upstream migration period occurs between January and June. CALSIM II flow outputs were examined during these periods for each model scenario.

Sacramento River

Macropthalmia

Flows the Sacramento River at Rio Vista (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) were examined during the December to May macropthalmia migration period. Flows under H3_ELT would generally be lower by up to 24% under H3_ELT relative to NAA_ELT. Based on the prevalence of moderate decreases in flow in drier water years for much of migration period, H3_ELT would affect Pacific lamprey macropthalmia migration conditions at this location. In the Sacramento River upstream of Red Bluff (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*), flows under H3_ELT during December through May would be similar to or up to 9% greater than flows under NAA_ELT.

Adults

Flows in the Sacramento River at Red Bluff (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) were examined during the January to June adult migration period. Flows under H3_ELT would be similar to or up to 9% greater than flows under NAA_ELT. These results indicate that H3_ELT would generally not affect adult migration conditions in the Sacramento River.

Feather River

Macropthalmia

Flows in the Feather River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) were examined during the December to May macropthalmia migration period. Flows under H3_ELT during would generally be similar to or greater (up to 12% greater) than flows under NAA_ELT. These results indicate that effects of H3_ELT on macropthalmia migration flows in the Feather River would generally be negligible.

Adults

Flows in the Feather River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) were examined during the January through June adult migration period. Flows under H3_ELT would generally be similar to flows under NAA_ELT during January through May and greater by up to 77% during June. These results indicate that H3_ELT would have no effect or a beneficial effect on adult migration conditions in the Feather River.

American River

Macropthalmia

Flows in the American River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) were examined during the December through May macropthalmia migration period. Flows under H3_ELT would generally be similar to flows under NAA_ELT with few small exceptions. These results indicate that H3_ELT would not have negative effects on macropthalmia migration conditions in the American River.

Adults

Flows in the American River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) were examined during the January to June adult migration period. Flows under H3_ELT during January through May would generally be similar to flows under NAA_ELT with few small exceptions. Flows under H3_ELT during June would generally be greater by up to 25% than flows under NAA_ELT. These results indicate that H3_ELT would have no effect or a beneficial effect on adult migration conditions in the American River.

H4_ELT/HOS

Flows at Rio Vista would be up to 12% lower under H4_ELT relative to NAA_ELT during December through April and there would be no differences during May. Flows in the Sacramento River upstream of Red Bluff under H4_ELT during the December through May macropthalmia migration period would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*), indicating that migration conditions for macropthalmia in this reach would be unaffected under. Flows in the Sacramento River at Red Bluff under H4_ELT during the January through June migration period would generally be similar to flows under NAA_ELT. Overall, flows at Rio Vista under H4_ELT would be slightly lower on average than flows under NAA_ELT and flows would not differ between NAA_ELT and H4_ELT at Red Bluff.

Flows in the Feather River at the confluence with the Sacramento River under H4_ELT during the December through May macropthalmia migration period would generally be similar to or greater than (up to 119% greater) flows under H3_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*), indicating that migration conditions for macropthalmia would be improved under H4_ELT relative to NAA_ELT in the Feather River. Flows under H4_ELT during the January through June adult migration period would generally be similar to or greater than (up to 119% greater) flows under H3_ELT, indicating that migration conditions for adults would also be improved under H4_ELT relative to NAA_ELT in the Feather River.

Flows in the American River at the confluence with the Sacramento River under H4_ELT during the December through May macropthalmia migration period and the January through June adult migration period would generally be similar to or greater than flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

These results indicate that there would be small negative effects of Alternative 4A on lamprey migration flows in the Sacramento River, moderately large benefits in the Feather River, and no effect in the American River.

NEPA Effects: Collectively, these modeling results indicate that the effect is not adverse because it would not substantially reduce or degrade migration habitat or substantially reduce the number of fish as a result of mortality. There would be small to moderate negative effects of Alternative 4A on lamprey migration flows in the Sacramento River at Rio Vista, no effect (under H3_ELT) or moderately large benefits (under H4_ELT) in the Feather River, and no effect in the Sacramento River at Red Bluff and in the American River. Combined, these effects would not result in adverse effects on migration conditions for Pacific lamprey.

CEQA Conclusion: In general, Alternative 4A would not reduce the quantity and quality of migration habitat for Pacific lamprey relative to Existing Conditions.

H3_ELT/ESO_ELT

Sacramento River

Macropthalmia

Comparisons of mean monthly flow rates for H3_ELT to Existing Conditions in the Sacramento River at Rio Vista (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) for December to May indicate that flows would be up to 47% lower under H3_ELT compared to Existing Conditions.

Comparisons for the Sacramento River at Red Bluff (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) for December to May indicate negligible effects (<5%) or small increases or decreases in flow (up to 10%) under H3_ELT that would not have biologically meaningful effects on migration conditions relative to Existing Conditions.

Adults

Comparisons of mean monthly flow for the Sacramento River at Red Bluff (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) for January through June for H3_ELT relative to Existing Conditions indicate that for most months and water year types, flows under H3_ELT would be similar to (<5% difference) or greater than flows under Existing Conditions, with some increases and decreases in mean monthly flow that would not have biologically meaningful effects on migration.

Feather River

Macropthalmia

Comparisons for the Feather River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) for December to May indicate variable effects of H3_ELT relative to Existing Conditions by month and water year type, with negligible effects (<5%), moderate increases in flow (to 18%) that would be beneficial for migration conditions, with occasional occurrences of moderate decreases in flow to -19%. These results indicate that the effects of H3_ELT on flows would not have negative effects on macropthalmia migration in the Feather River.

Adults

Comparisons of mean monthly flow for the Feather River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) for January to June indicate variable effects of H3_ELT relative to Existing Conditions depending on the month and water year type, with primarily negligible effects (<5%), small to substantial increases in flow (to 71%) that would have a beneficial effect on migration conditions, and occasional small to moderate decreases in flow (up to 19%). Based on the prevalence of negligible effects and increases in flow which would have a beneficial effect on migration conditions, and only occasional reductions in flow of small to moderate magnitude, these results indicate that effects of H3_ELT on flow would not have biologically meaningful negative effects on adult migration conditions in the Feather River.

American River

Macropthalmia

Comparisons for the American River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) for December to May indicate variable effects of H3_ELT relative to Existing Conditions, with negligible effects (<5%) during April, increases (up to 15%) during February and March that would be beneficial on migration conditions, and decreases (up to -18%) during January and May. Due to the low magnitude and frequency of increases and decreases in flow, these differences would not have biologically meaningful positive or negative effects on macropthalmia migration conditions in the American River.

Adults

Comparisons of mean monthly flow for the American River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) for January to June indicate variable effects of H3_ELT relative to Existing Conditions, with negligible effects (<5%), increases (up to 15%) that would be beneficial on migration conditions, and decreases (to -35%). Based on the balance of increases and decreases in flows, these results indicate that effects of H3_ELT on flow would not have biologically meaningful negative effects on adult migration conditions in the American River.

H4_ELT/HOS

Flows in the Sacramento River at Rio Vista during the December through May macropthalmia migration period under H4_ELT would be mostly lower by up to 17% than flows under Existing Conditions. Flows upstream of Red Bluff under H4_ELT during December through May would generally be similar to or greater than (up to 9% greater) flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*), indicating that migration conditions for Pacific lamprey macropthalmia would be largely unaffected by H4_ELT. Flows in the Sacramento River at Red Bluff under H4_ELT during the January through June migration period would generally be similar to or greater than (up to 9% greater) flows under NAA_ELT, indicating that migration conditions for adults would be largely unaffected by H4_ELT.

Flows in the Feather River at the confluence with the Sacramento River under H4_ELT during the December through May macropthalmia migration period would generally be similar to or greater than (up to 112% greater) flows under Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*), indicating that migration conditions for macropthalmia would be similar to or improved under H4_ELT. Flows in the Feather River at the confluence with the Sacramento River under H4_ELT during the January through June migration period would generally be similar to or greater than (up to 112% greater) flows under Existing Conditions, except during June in which flows under H4_ELT would be up to 28% lower. Overall, flows in the Feather River would be higher under H4_ELT than those under Existing Conditions during the adult migration period.

Differences in flows in the American River at the confluence with the Sacramento River under H4_ELT during the December through May macropthalmia migration period and the January through June adult migration period would generally be similar. Flows under H4_ELT would be similar to those under Existing Conditions during December, March, and April, higher during January, February, and March, and lower during May and June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Due to the wide variation in results, it is concluded that the effects will not be negative.

These results indicate that the effects of H4_ELT on Pacific lamprey migration conditions would generally be similar to those under Existing Conditions.

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the effect is less than significant because it would not substantially reduce or degrade migration habitat or substantially reduce the number of fish as a result of mortality. There would be small to moderate negative effects of Alternative 4A on lamprey migration flows in the Sacramento River at Rio Vista, no effect (under H3_ELT) or moderately large benefits (under H4_ELT) in the Feather River, and no effect in the Sacramento River at Red Bluff and in the American River. Combined, these effects would not have a population level effect on Pacific lamprey. Therefore, the impact is less than significant and no mitigation is required.

Restoration Measures (Environmental Commitments 4, Environmental Commitment 6, Environmental Commitment 7, and Environmental Commitment 10)

As described for other covered fishes, Alternative 4A includes a greatly reduced extent of restoration measures relative to Alternative 4 and Alternative 1A. The mechanisms of impacts of habitat restoration discussed for other covered species such as winter-run Chinook salmon generally would be similar for Pacific lamprey. Pacific lamprey would have the potential to encounter restoration-related effects. However, because the extent of restoration is limited to offsetting losses from construction of the water conveyance facilities, any such effects would be greatly limited compared to Alternative 1A and 4, for example.

Impact AQUA-169: Effects of Construction of Restoration Measures on Pacific Lamprey

As noted for Alternative 1A's discussion of Impact AQUA-133, in-water and shoreline construction activities (e.g., riprap removal and levee breaching; shoreline excavation and recontouring) could increase turbidity, but Pacific lamprey are tolerant to such increases and implementation of the environmental commitments described under Impact AQUA-1 for delta smelt and in Appendix 3B, *Environmental Commitments* (Environmental Training; Stormwater Pollution Prevention Plan; Erosion and Sediment Control Plan; Hazardous Materials Management Plan; Spill Prevention, Containment, and Countermeasure Plan; and Disposal of Spoils, Reusable Tunnel Material, and Dredged Material), would minimize or eliminate effects on Pacific lamprey.

NEPA Effects: The effects of short-term construction activities would not be adverse to Pacific lamprey because environmental commitments would limit the potential for construction-related effects.

CEQA Conclusion: As discussed for Alternative 1A, habitat restoration activities could result in short-term effects on Pacific lamprey but would be localized, sporadic, and of low magnitude; such effects would be avoided by limiting the frequency, duration, and spatial extent of in-water work and with implementation of environmental commitments (see Appendix 3B, *Environmental*

Commitments). The potential impact of habitat restoration activities is considered less than significant because it would not substantially reduce Pacific lamprey habitat, restrict its range, or interfere with its movement. No additional mitigation would be required.

Impact AQUA-170: Effects of Contaminants Associated with Restoration Measures on Pacific Lamprey

The factors influencing the potential effects of contaminants from restored areas on Pacific lamprey are discussed in the analysis of Impact AQUA-170 under Alternative 1A. Because the extent of habitat restoration under Alternative 4A is considerably reduced relative to Alternative 1A, any effects from contaminants also would be considerably reduced.

NEPA Effects: As noted for other covered fishes, while Alternative 4A habitat restoration actions may result in a very small increase production, mobilization, and bioavailability of methylmercury, selenium, copper, and pesticides in the aquatic system, any such releases would be short-term and localized, and would be unlikely to result in measurable increases in the bioaccumulation of these contaminants in Pacific lamprey. Overall, the effects of contaminants associated with restoration measures would not be adverse for Pacific lamprey.

CEQA Conclusion: As noted for other covered fishes, habitat restoration under Alternative 4A may result in increased production, mobilization, and bioavailability of contaminants in the aquatic system, but these would be short-term and localized, and would be unlikely to result in measurable increases in the bioaccumulation in Pacific lamprey. For methylmercury, implementation of *Environmental Commitment 12 Methylmercury Management* would help to minimize the increased mobilization of methylmercury in the limited restoration areas. Therefore, the impact of contaminants is considered less than significant because it would not substantially affect Pacific lamprey either directly or through habitat modifications. Consequently, no mitigation would be required.

Impact AQUA-171: Effects of Restored Habitat Conditions on Pacific Lamprey

Restored habitat under *Environmental Commitment 4 Tidal Natural Communities Restoration* and *Environmental Commitment 6 Channel Margin Enhancement* is intended to offset habitat loss/modification caused by construction and operation of the water facilities proposed under Alternative 4A.

NEPA Effects: The effects of restored habitat conditions on Pacific lamprey would not be adverse restoration could provide habitat benefits for lamprey.

CEQA Conclusion: As described above, habitat restoration would be undertaken to offset loss/modification of habitat from water facility construction and operation. The effects of restored habitat conditions on Pacific lamprey would be less than significant. Consequently, no mitigation would be required.

Other Environmental Commitments (Environmental Commitment 12, Environmental Commitment 15, and Environmental Commitment 16)

As noted for other covered species, Alternative 4A includes three other conservation measures, which are reduced in their extent relative to other Alternatives (e.g., Alternative 1A and Alternative 4). While the extent of these measures is reduced compared to these alternatives, the nature of the mechanisms for Pacific lamprey remains the same.

Impact AQUA-172: Effects of Methylmercury Management on Pacific Lamprey (Environmental Commitment 12)

The impact discussion for winter-run Chinook salmon (Impact AQUA-46) is also applicable to Pacific lamprey.

NEPA Effects: The effects of methylmercury management on Pacific lamprey would not be adverse because it is expected to reduce overall methylmercury levels resulting from habitat restoration.

CEQA Conclusion: As noted for winter-run Chinook salmon, effects of *Environmental Commitment 12 Methylmercury Management* within the areas restored under Alternative 4A are expected to reduce overall methylmercury levels resulting from habitat restoration. Because it is designed to improve water quality and habitat conditions, impacts on Pacific lamprey would be less than significant. Consequently, no mitigation is required.

Impact AQUA-175: Effects of Localized Reduction of Predatory Fish on Pacific Lamprey (Environmental Commitment 15)

It is possible, but not assured, that there would be some reduction in predation losses of Pacific lamprey under *Environmental Commitment 15 Localized Reduction of Predatory Fish*; for Alternative 4A, such efforts would be focused at the NDD and at the south Delta export facilities. There is uncertainty in the potential efficacy of Environmental Commitment 15 and also uncertainty in the importance of predation to Pacific lamprey. Due to these uncertainties, there would be no demonstrable effect of this conservation measure on Pacific lamprey.

NEPA Effects: Consistent with the analysis for Alternative 1A and reflecting the above discussion, the overall effect would not be adverse.

CEQA Conclusion: Consistent with the analysis for Alternative 1A and reflecting the above discussion, the impact is considered less than significant. Consequently, no mitigation would be required.

Impact AQUA-176: Effects of Nonphysical Fish Barriers on Pacific Lamprey (Environmental Commitment 16)

As described for winter-run Chinook salmon, under Alternative 4A, an NPB at the divergence of Georgiana Slough from the Sacramento River would be implemented to guide juvenile salmonids away from Georgiana Slough and the interior Delta, wherein survival is relatively low compared to the Sacramento River (Perry et al. 2010). As described in the *BDCP Effects Analysis*, the effects of an NPB at this location would be expected to have little to no effect on Pacific lamprey because of their physiology (limited hearing ability in the range employed by the NPB's acoustic deterrence stimuli; see section 5C.5.3.9 in *BDCP Effects Analysis Appendix 5.C* and section 5.B.6.1.11.1 *BDCP Effects Analysis Appendix 5.B, both hereby incorporated by reference*). As noted in the discussion of Impact AQUA-180 for Alternative 1A, the NPB may attract piscivorous predators but the additional predation on Pacific lamprey is expected to be low.

NEPA Effects: The overall effect of the NPB on Pacific lamprey would not be adverse because of their limited hearing ability in the range employed by the NPB's acoustic deterrence stimuli.

CEQA Conclusion: Consistent with the analysis for Alternative 1A and reflecting the above discussion, the impact of the NPB on Pacific lamprey is considered less than significant because of their limited hearing ability in the range employed by the NPB's acoustic deterrence stimuli. Consequently, no mitigation would be required.

River Lamprey

Construction and Maintenance of Water Conveyance Facilities

Impact AQUA-181: Effects of Construction of Water Conveyance Facilities on River Lamprey

The potential effects of construction of water conveyance facilities on river lamprey would be the same as those described for Alternative 4 Impact AQUA-181. This section provides additional detail on underwater noise impacts which are also applicable to Impact AQUA-181 in Alternative 4.

Table 11-8 presents the life stages of river lamprey and months of their potential presence in the north, east, and south Delta during the proposed in-water construction window (June 1–October 31). Little is known about the distribution and abundance of river lamprey, but salvage records at the south Delta export facilities indicate that they could be present in the Delta during this period. It is assumed that the discussion above for Pacific lamprey generally applies to river lamprey. Thus, underwater construction noise could adversely affect small numbers of river lamprey but would not result in significant population-level effects.

NEPA Effects: As concluded for Alternative 4, Impact AQUA-181, the effect would not be adverse for river lamprey. Implementation of the measures described in Appendix 3B, *Environmental Commitments*, such as *Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue and Salvage Plan*; and *Barge Operations Plan* would guide rapid and effective response in the case of inadvertent spills of hazardous materials. This species' natural tolerance to turbidity would likely avoid the risk of any adverse turbidity effects resulting from project construction. Construction would not be expected to increase predation rates relative to baseline conditions. Construction will result in both temporary and permanent alteration of rearing and migratory habitats used by river lamprey. However, Alternative 4A includes Environmental Commitment 4 to restore tidal habitat. The direct effects of underwater construction noise on river lamprey that may be present could be adverse if river lamprey are exposed. However, implementation of Mitigation Measures AQUA-1a and AQUA-1b, combined with the in-water work window that would minimize exposure, would reduce the potential for effects from underwater noise and this effect would not be adverse.

CEQA Conclusion: As described in Alternative 4, Impact AQUA-181, the impact of the construction of water conveyance facilities on river lamprey would not be significant except for construction noise associated with pile driving. Construction of Alternative 4A involves several elements with the potential to affect river lamprey. However, these turbidity and hazardous material spill effects will be effectively avoided and/or minimized through implementation of environmental commitments (see Impact AQUA-1 and Appendix 3B, *Environmental Commitments*: *Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue and Salvage Plan*; and *Barge Operations Plan*). Implementation of Mitigation Measures AQUA-1a and AQUA-1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Impact AQUA-182: Effects of Maintenance of Water Conveyance Facilities on River Lamprey

The potential effects of the maintenance of water conveyance facilities under Alternative 4 would be the same as those described for Alternative 1A (see Impact AQUA-182) except that only three intakes would need to be maintained under Alternative 4 rather than five under Alternative 1A, resulting in less impacts. As concluded in Alternative 1A, Impact AQUA-182, the impact would not be adverse for river lamprey.

CEQA Conclusion: As described in Alternative 1A, Impact AQUA-182, the impact of the maintenance of water conveyance facilities on river lamprey would be less than significant and no mitigation is required.

Operations of Water Conveyance Facilities

Impact AQUA-183: Effects of Water Operations on Entrainment of River Lamprey

Water Exports

The impact on entrainment of river lamprey at water operations facilities in the south and north Delta is expected to be the same as described for Pacific lamprey (see Impact AQUA-165). Entrainment losses at the south Delta facilities would be reduced for both flow scenarios under Alternative 4A compared to NAA_ELT. The potential impacts at the proposed new north Delta intakes are unknown since little is known about the river lamprey life history in the Delta.

Predation Associated with Entrainment

Entrainment-related predation loss of lamprey at the south Delta facilities would not be greater under this Alternative compared to the NAA_ELT and may be lower due to a reduction in entrainment loss. Conditions under Scenario H4_ELT would decrease predation loss relative to NAA_ELT and Scenario H3_ELT. Predation at the north Delta would be increased due to the installation of the proposed water export facilities on the Sacramento River. The effect on lamprey from predation loss at the north Delta facilities is unknown because of the lack of knowledge about their distribution and population abundances in the Delta.

NEPA Effects: Overall, the effect of entrainment and entrainment-related predation would not be adverse because entrainment, and predation associated with entrainment, would be reduced under Alternative 4A.

CEQA Conclusion: As described above for Pacific lamprey (which is assumed to have the same entrainment effects as river lamprey), annual entrainment losses of lamprey would be substantially reduced under both flow scenarios for Alternative 4A relative to existing biological conditions. Lamprey predation loss at the south Delta facilities would not be increased relative to Existing Conditions and may be decreased due to reduction entrainment losses. The impact of predation loss at the north Delta is unknown, since there is little available knowledge on the distribution and abundance in the Delta, especially in the vicinity of the proposed new north Delta intakes. Overall, the impacts of Alternative 4A water operations to river lamprey are considered less than significant because they would reduce entrainment and potentially entrainment-related predation. No mitigation would be required.

Impact AQUA-184: Effects of Water Operations on Spawning and Egg Incubation Habitat for River Lamprey

In general, the effect of Alternative 4A would be negligible relative to the NAA_ELT.

H3_ELT/ESO_ELT

Flow-related impacts to river lamprey spawning habitat were evaluated by estimating effects of flow alterations on redd dewatering risk as described for Pacific lamprey with appropriate time-frames for river lamprey incorporated into the analysis. The same locations were analyzed as for Pacific lamprey: the Sacramento River at Keswick and Red Bluff, Trinity River downstream of Lewiston, Feather River at Thermalito Afterbay, and the American River at Nimbus Dam and at the confluence with the Sacramento River. River lamprey spawn in these rivers between February and June so flow reductions during those months have the potential to dewater redds, which could result in incomplete development of the eggs to ammocoetes (the larval stage).

Dewatering risk to redd cohorts was characterized by the number of cohorts experiencing a month-over-month reduction in flows (using CALSIM II outputs) of greater than 50%. Small-scale spawning location suitability characteristics (e.g., depth, velocity, and substrate) of river lamprey are not adequately described to employ a more formal analysis such as a weighted usable area analysis. Therefore, as described for Pacific lamprey, there is uncertainty that these values represent actual redd dewatering events, and results should be treated as rough estimates of flow fluctuations under each model scenario. Results were expressed as the number of cohorts exposed to dewatering risk and as a percentage of the total number of cohorts anticipated in the river based on the applicable time-frame, February to June.

There would be negligible differences between H3_ELT and NAA_ELT in exposure to flow reductions in all rivers except for a small decrease (8% lower) in the American River at Nimbus Dam (Table 11-4A-127). These results indicate that H3_ELT would not have biologically meaningful effects on river lamprey redd cohorts predicted to experience a month-over-month change in flow of greater than 50% in all locations analyzed.

Table 11-4A-127. Differences between Model Scenarios in Dewatering Risk of River Lamprey Redd Cohorts[a]

Location	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Sacramento River at Keswick	3 (9%)	0 (0%)
Sacramento River at Red Bluff	4 (11%)	1 (3%)
Trinity River downstream of Lewiston	-2 (-3%)	0 (0%)
Feather River below Thermalito Afterbay	-3 (-4%)	-3 (-4%)
American River at Nimbus	4 (7%)	-5 (-8%)
American River at Sacramento River confluence	12 (20%)	0 (0%)

[a] Difference and percent difference between model scenarios in the number of river lamprey redd cohorts experiencing a month-over-month reduction in flows of greater than 50%. Positive values indicate a higher value in H3_ELT than in Existing Conditions or NAA_ELT.

River lamprey generally spawn between February and June (Beamish 1980; Moyle 2002). Using Pacific lamprey as a surrogate, eggs are assumed to hatch in 18-49 days depending on water temperature (Brumo 2006) and are, therefore, assumed to be present during roughly the same period and locations as spawners. Moyle et al. (1995) indicate that river lamprey "adults need… temperatures [that] do not exceed 25°C," although there is no mention of thermal requirements for eggs in this or any existing literature. Meeuwig et al. (2005) reported that, for Pacific lamprey eggs, significant reductions in survival were observed at 22°C (71.6°F). Therefore, for this analysis, both temperatures, 22°C (71.6°F) and 25°C (77°F), were used as upper thresholds of river lamprey eggs. The analysis predicted the number of consecutive 49 day periods for the entire 82-year CALSIM period during which at least one day exceeds 22°C (71.6°F) or 25°C (77°F) using daily data from USRWQM. For other rivers, the analysis predicted the number of consecutive two-month periods during which at least one month exceeds 22°C (71.6°F) or 25°C (77°F) using monthly averaged data from the Bureau's temperature model. Each individual day or month starts a new "egg cohort" such that there are 12.320 cohorts for the Sacramento River, corresponding to 82 years of eggs being laid every day each year from February 1 through June 30, and 405 cohorts for the other rivers using monthly data over the same period. The incubation periods used in this analysis are conservative and represent the extreme long end of the egg incubation period (Brumo 2006). Also, the utility of the monthly average time step is limited because the extreme temperatures are masked; however, no better analytical tools are currently available for this analysis. Spawning locations of river lamprey are not well defined. Therefore, this analysis uses the widest range in which the species is thought to spawn in each river.

For both thresholds, there would be few differences in egg cohort exposure between NAA_ELT and H3_ELT among all sites (Table 11-4A-128). In most cases, absolute differences account for <5% of the total number of cohorts. The two exceptions are for the 71.6 °F threshold in the Feather River at Thermalito Afterbay (7% absolute increase) and for the 77 °F threshold in American River at the Sacramento River Confluence (11% absolute decrease). However, due to the low magnitude and frequency, there would be no population level effects of this increase and decrease in temperature exposure to river lamprey eggs.

Table 11-4A-128. Differences (Percent Differences) between Model Scenarios in River Lamprey Egg Cohort Temperature Exposure[a]

Location	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Temperatures above 71.6°F		
Sacramento River at Keswick	0 (NA)	0 (NA)
Sacramento River at Hamilton City	100 (NA)	-1 (-1%)
Trinity River at Lewiston	0 (NA)	0 (NA)
Trinity River at North Fork	1 (NA)	0 (0%)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	11 (122%)	7 (54%)
American River at Nimbus	12 (240%)	-2 (-11%)
American River at Sacramento River Confluence	18 (64%)	-11 (-19%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	11 (1100%)	0 (0%)
Temperatures above 77°F		
Sacramento River at Keswick	0 (NA)	0 (NA)
Sacramento River at Hamilton City	0 (NA)	0 (NA)
Trinity River at Lewiston	0 (NA)	0 (NA)
Trinity River at North Fork	0 (NA)	0 (NA)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	2 (NA)	2 (NA)
American River at Nimbus	1 (NA)	0 (0%)
American River at Sacramento River Confluence	3 (NA)	0 (0%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

[a] Difference and percent difference between model scenarios in the number of river lamprey egg cohorts experiencing water temperatures above 71.6°F and 77°F during February through June on at least one day during a 49-day incubation period in the Sacramento River or for at least one month during a 2-month incubation period in other rivers for each model scenario. Positive values indicate a higher value in H3_ELT than in EXISTING CONDITIONS or NAA_ELT.

H4_ELT/HOS

Flows during January through August under H4_ELT would generally be similar to or greater than flows under H3_ELT in all rivers except the Feather River. As a result, the redd dewatering risk analysis was not conducted for H4_ELT in these rivers and results for H4_ELT would be the same as those for H3_ELT.

In the Feather River at Thermalito Afterbay, there would be 23 more cohorts (20%) exposed to a 50% month over month drop in flow rate under H4_ELT relative to NAA_ELT (Table 11-4A-129). This change of 23 cohorts out of 410 cohorts equated to ~6% of all cohorts, which is not considered substantial to the population.

Table 11-4A-129. Differences between Model Scenarios in Dewatering Risk of River Lamprey Redd Cohorts[a]

Location	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Feather River at Thermalito Afterbay	-14 (-9%)	23 (20%)

[a] Difference and percent difference between model scenarios in the number of river lamprey redd cohorts experiencing a month-over-month reduction in flows of greater than 50%. Positive values indicate a higher value in H1 or H4_ELT than in Existing Conditions or NAA_ELT.

Water temperatures would not differ between H4_ELT and H3_ELT and, therefore, no egg cohort temperature analyses were conducted. Overall, results for H4_ELT would be similar to those for H3_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect is not adverse because it would not substantially reduce suitable spawning habitat or substantially reduce the number of fish as a result of egg mortality. Effects of Alternative 4A on river lamprey redd dewatering risk and exposure risk of eggs to elevated water temperatures would be small or negligible for all locations analyzed.

CEQA Conclusion: Collectively, the results of the Impact AQUA-166 CEQA analysis show that the difference between the CEQA baseline and Alternative 4A is less than significant.

H3_ELT/ESO_ELT

Dewatering risk during the river lamprey spawning period from February to June would generally be similar to slightly higher under H3_ELT relative to Existing Conditions (Table 11-4A-127). The largest difference would be in the American River at the Sacramento River confluence (12 cohorts, or 20% increase). An increase in 12 cohorts of the 410 total cohorts would represent <3% of total cohorts. As a result, it is concluded that this increase would not represent a biological meaningful effect to river lamprey.

Egg cohort temperature exposure results are reported in Table 11-4A-128. There would be either negligible differences or an increase in exposure of egg cohorts (11 to 18 cohorts, or 64% to 1,100%) under H3_ELT relative to Existing Conditions to temperatures above 71.6°F in the Feather River, American River, and Stanislaus River and an increase of up to 100 cohorts in the Sacramento River. However, none of these increases would compose more than 5% of the 410 total ammocoete cohort count and, therefore, would not be biologically relevant to the species. There would be negligible differences in the number of cohorts exposed to temperatures above 77°F under H3_ELT relative to Existing Conditions.

H4_ELT/HOS

Flows during February through June under H4_ELT would generally be similar to or greater than flows under H3_ELT in all rivers except the Feather River. As a result, the redd dewatering risk analysis was not conducted for H4_ELT in these rivers and results for H4_ELT would be the same as those for H3_ELT.

In the Feather River at Thermalito Afterbay, there would be 14 (9%) more cohorts (Table 11-4A-129). This increase would be too small to have a biologically meaningful effect on river lamprey.

Water temperatures under H4_ELT would be similar to those under H3_ELT for all rivers examined. Therefore, no additional cohort temperature exposure analyses were conducted for H4_ELT.

Overall, results for H4_ELT would be similar to those for H3_ELT.

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the effect is less than significant because it would not substantially reduce suitable spawning habitat or substantially reduce the number of fish as a result of egg mortality. Effects of Alternative 4A on river lamprey redd dewatering risk and exposure risk of eggs to elevated water temperatures would be small or negligible for all locations analyzed. No mitigation is necessary.

Impact AQUA-185: Effects of Water Operations on Rearing Habitat for River Lamprey

In general, the effect of Alternative 4A would be negligible relative to the NAA_ELT.

H3_ELT/ESO_ELT

Flow-related impacts to river lamprey rearing habitat were evaluated by estimating of the frequency of rapid flow reductions in ammocoete rearing areas. Rapid reductions in flow can strand ammocoetes, leading to mortality. Comparisons of effects were made for ammocoete cohorts, as described for Pacific lamprey, in the Sacramento River at Keswick and Red Bluff, the Trinity River, Feather River, and the American River at Nimbus Dam and at the confluence with the Sacramento River.

As for Pacific lamprey, the analysis of river lamprey ammocoete stranding was conducted by analyzing a range of month-over-month flow reductions from CALSIM II outputs, using the range of 50%–90% in 5% increments. A cohort of ammocoetes was assumed to be born every month during their spawning period (February through June) and spend 5 years rearing upstream. Therefore, a cohort was considered stranded if at least one month-over-month flow reduction was greater than the flow reduction at any time during the period.

Comparisons of H3_ELT to NAA_ELT for the Sacramento River at Keswick (Table 11-4A-130) indicate that there would be no effect (0%) or negligible effects (≤5%) attributable to H3_ELT in all flow reduction categories.

Table 11-4A-130. Percent Difference between Model Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Sacramento River at Keswick

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	2	0
-60%	6	5
-65%	1	-4
-70%	0	-5
-75%	4	3
-80%	7	0
-85%	111	0
-90%	NA	NA

NA = could not be calculated because the denominator was 0.
[a] Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

Results of comparisons for the Sacramento River at Red Bluff indicates that H3_ELT would have negligible effects (<5%) in all but the 55% flow increase category, which would cause a 6% increase in cohort exposure (Table 11-4A-131). Overall, this indicates that there would be minimal effect on ammocoete exposure.

Table 11-4A-131. Percent Difference between Model Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Sacramento River at Red Bluff

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	2
-55%	6	6
-60%	4	-2
-65%	-2	-3
-70%	2	0
-75%	19	0
-80%	23	0
-85%	0	0
-90%	NA	NA

NA = could not be calculated because the denominator was 0.
[a] Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

Comparisons for the Trinity River indicate that there would be no or negligible differences in ammocoete cohorts exposed flow reductions between H3_ELT and NAA_ELT for all flow reduction categories except 80-90%, which would be 5 to 11% higher under H3_ELT (Table 11-4A-132).

Table 11-4A-132. Percent Difference between Model Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Trinity River at Lewiston

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	0	0
-60%	0	0
-65%	0	0
-70%	0	0
-75%	27	0
-80%	30	5
-85%	33	6
-90%	49	11

[a] Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

In the Feather River at Thermalito Afterbay, there would be no difference in ammocoete cohort exposure at the 50% through 75% flow reductions (Table 11-4A-133). For the 80% through 90% flow reductions, ammocoete exposure would be 5% to 64% lower, which due to the low frequency with which 85% and 90% reductions in flow would occur, would not be frequent enough to have a biologically meaningful effect on river lamprey ammocoete rearing. These results indicate that there will be no effects of H3_ELT on river lamprey ammocoete rearing in the Feather River.

Table 11-4A-133. Percent Difference between Model Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Feather River at Thermalito Afterbay

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	0	0
-60%	0	0
-65%	0	0
-70%	0	0
-75%	-1	-1
-80%	-7	-5
-85%	-27	-32
-90%	-61	-64

[a] Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

Comparisons for the American River at Nimbus Dam (Table 11-4A-134) and at the confluence with the Sacramento River (Table 11-4A-135) have similar results. There would be no or negligible differences in cohort exposure between NAA_ELT and H3_ELT for most flow reduction categories. There would be higher cohort exposure under H3_ELT relative to NAA_ELT at Nimbus Dam at the 75% and 80% flow reductions (19% and 22% higher, respectively) and at the confluence with the

Sacramento River at the 80% and 85% flow reductions (9% and 32% higher, respectively) flow reductions. These results indicate that there would generally be no effect of H3_ELT on stranding risk in the American River with few small exceptions that would not be common enough to have biologically meaningful effects.

Table 11-4A-134. Percent Difference between Model Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, American River at Nimbus Dam

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	-1	-1
-60%	2	-1
-65%	5	0
-70%	45	4
-75%	119	19
-80%	292	22
-85%	100	0
-90%	-100	NA

NA = could not be calculated because the denominator was 0.
[a] Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

Table 11-4A-135. Relative Difference between Model Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, American River at the Confluence with the Sacramento River

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	0	0
-60%	3	1
-65%	3	2
-70%	20	4
-75%	33	2
-80%	235	9
-85%	270	32
-90%	100	0

[a] Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

Because the thermal tolerance of river lamprey ammocoetes is unknown, the thermal tolerance of Pacific lamprey ammocoetes of 22°C (71.6°F) and of river lamprey adults of 25°C (77°F) (Moyle et al. 1995) was used. River lamprey ammocoetes rear upstream for 3–5 years (Moyle 2002). To be conservative, this analysis assumed a maximum ammocoete duration of 5 years. Each individual day or month starts a new "cohort" such that there are 18,730 cohorts for the Sacramento River, corresponding to 82 years of ammocoetes being "born" every day each year from January 1 through August 31, and 380 cohorts for the other rivers using monthly data over the same period.

There would be differences in the number of ammocoete cohorts exposed to temperatures greater than the thresholds in most of the rivers, particularly for the 77°F threshold (Table 11-4A-136). However, each river with an increase in exposure would also have a site with a decrease in exposure of similar magnitude, except in the Feather River for the 77°F threshold. Overall, the increases and decreases are expected to balance out within rivers such that there would be no overall effect on river lamprey ammocoetes.

Table 11-4A-136. Differences (Percent Differences) between Model Scenarios in River Lamprey Ammocoete Cohorts Exposed to Temperatures in the Feather River Greater than 71.6°F and 77°F in at Least One Month

Location	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
71.6°F Threshold		
Sacramento River at Keswick[b]	0 (NA)	0 (NA)
Sacramento River at Hamilton City[b]	5775 (NA)	-11 (-0.2%)
Trinity River at Lewiston	25 (NA)	0 (0%)
Trinity River at North Fork	25 (NA)	0 (0%)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	135 (71%)	65 (25%)
American River at Nimbus	180 (200%)	0 (0%)
American River at Sacramento River Confluence	120 (49%)	5 (1%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	155 (620%)	0 (0%)
77°F Threshold		
Sacramento River at Keswick[b]	0 (0%)	0 (NA)
Sacramento River at Hamilton City[b]	0 (0%)	4404 (NA)
Trinity River at Lewiston	0 (NA)	0 (NA)
Trinity River at North Fork	0 (NA)	0 (NA)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	50 (NA)	25 (100%)
American River at Nimbus	75 (NA)	25 (50%)
American River at Sacramento River Confluence	80 (NA)	-25 (-24%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.
[a] Positive values indicate a higher value in H3_ELT than in EXISTING CONDITIONS or NAA_ELT.
[b] Based on daily data; all other locations use monthly data; 1922–2003.

H4_ELT/HOS

There would be generally no differences in mean flows year-round between H4_ELT and H3_ELT in the Sacramento, Trinity, and American rivers. Therefore, ammocoete stranding risk analysis was conducted only for the Feather River.

In the Feather River at Thermalito Afterbay, there would be no or a negligible difference in ammocoete cohort exposure between NAA_ELT and H4_ELT at the 50% through 80% flow reductions (Table 11-4A-137). For the 85% and 90% flow reductions, ammocoete exposure under H4_ELT would be 14% and 47% higher, respectively.

Table 11-4A-137. Percent Difference between Baselines and H4_ELT Model Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Feather River at Thermalito Afterbay

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
-50%	0	0
-55%	0	0
-60%	0	0
-65%	0	0
-70%	0	0
-75%	0	0
-80%	2	5
-85%	22	14
-90%	57	47

[a] Negative values indicate reduced cohort exposure under H4_ELT.

There would generally be no differences in mean water temperatures year-round between H4_ELT and H3_ELT in any river examined. As a result, no additional ammocoete cohort exposure analyses were conducted for H4_ELT. Results of these analyses for H4_ELT would be the same as those for H3_ELT.

Overall, these results indicate that results for H4_ELT would generally be similar to those under H3_ELT except for an increase in ammocoete stranding risk exposure in the Feather River at 85% and 90% flow reductions under H4_ELT. The 85% and 90% flow reductions would occur rarely—19 and 7 times under NAA_ELT and 22 and 10 times, respectively—under H4_ELT, throughout the 985 months evaluated. Therefore, these reductions would affect a small proportion of the population. These results indicate that there would be no biologically meaningful effect of H4_ELT on stranding risk.

NEPA Effects: These modeling results indicate the effect would not be adverse because it would not substantially reduce rearing habitat or substantially reduce the number of fish through ammocoete mortality. Project-related effects on flow reductions and effects on water temperatures in all locations analyzed would be negligible and would not affect river lamprey ammocoete stranding risk and rearing success because the changes would not be large enough or frequent enough to be biologically meaningful.

CEQA Conclusion: In general, Alternative 4A would reduce the quantity and quality of rearing habitat for river lamprey relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, reviewing the alternative's impacts in relation to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demand. Informed by the NAA_ELT comparison, Alternative 4A would not affect the quantity and quality of rearing habitat for river lamprey relative to NAA_ELT.

H3_ELT/ESO_ELT

Comparisons of H3_ELT to Existing Conditions for the Sacramento River at Keswick indicate negligible effects (<5%) or small increases (to 7%) for ammocoete cohort exposures to flow reductions from 50% to 80% and 90%, and a more substantial increase in exposure (111%) to 85% flow reduction events (Table 11-4A-130). Comparisons for the Sacramento River at Red Bluff indicate similar results with negligible effects (<5%) or small increases in exposure (to 6%) for 50% to 70% and 85% to 90% flow reduction categories, and a more substantial increases in exposure (19% to 23%) in the 80% and 85% flow reduction categories, respectively (Table 11-4A-131). Based on the prevalence of small and negligible effects, the effects of a more substantial increase in flow reductions in a single flow reduction category would not be considered biologically meaningful to river lamprey in the Sacramento River.

Comparisons for the Trinity River between H3_ELT and Existing Conditions indicated no effect (0%) for the lower flow reduction categories up to 70%, and increases in occurrence ranging from 27% to 49% for the 75% through 90% flow reduction categories (Table 11-4A-132). The prevalence of increased occurrence of higher-magnitude flow reductions would affect river lamprey ammocoete stranding in the Trinity River.

Comparisons for the Feather River between H3_ELT and Existing Conditions indicated no effect (0%) or reductions in frequency of occurrence for all flow reduction categories, with 7% to 61% reductions in cohorts exposed to 80% to 90% flow reduction events (Table 11-4A-133). Due to the low frequency with which 85% and 90% reductions in flow would occur, would not be frequent enough to have a biologically meaningful effect on river lamprey ammocoete rearing.

Comparisons for the American River at Nimbus Dam (Table 11-4A-134) and at the confluence with the Sacramento River (Table 11-4A-135) between H3_ELT and Existing Conditions indicate a 45% to 292% increased chance of occurrence of flow reductions between 70 and 85% under H3_ELT compared to NAA_ELT at Nimbus Dam and a 20% to 270% increased chance of occurrence of flows reductions between 70% and 85% at the confluence with the Sacramento River. The prevalence of increased occurrence of higher-magnitude flow reductions would constitute a biologically meaningful effect on river lamprey ammocoete stranding in the American River.

The number of ammocoete cohorts exposed to 71.6°F under H3_ELT (including climate change) would be up to 620% higher than those under Existing Conditions in most locations examined (Table 11-A1-136). The number of ammocoete cohorts exposed to 77°F would be similar between Existing Conditions and H3_ELT in the Sacramento, Trinity, and Stanislaus Rivers, but 50 to 80 cohorts higher in the Feather and American Rivers (percent differences could not be calculated because there would be 0 cohorts under Existing Conditions).

H4_ELT/HOS

There would be generally no differences in mean flows year-round between H4_ELT and H3_ELT in the Sacramento, Trinity, and American rivers. Therefore, ammocoete stranding risk analysis was conducted only for the Feather River.

In the Feather River at Thermalito Afterbay, there would be no or a negligible difference in ammocoete cohort exposure between Existing Conditions and H4_ELT at the 50% through 80% flow reductions (Table 11-4A-137). There would be 22% and 57% more cohorts exposed to 85% and 90% flow reductions, respectively, under H3_ELT relative to Existing Conditions.

There would generally be no differences in mean water temperatures year-round between H4_ELT and H3_ELT in any river examined. As a result, no additional ammocoete temperature cohort exposure analyses were conducted for H4_ELT. Results of these analyses for H4_ELT would be the same as those for H3_ELT.

Overall, these results indicate that results for H4_ELT would generally be similar to those under H3_ELT.

Summary of CEQA Conclusion

Under Alternative 4A, there would be moderate to substantial persistent increases in occurrence of flow reduction events for Alternative 4A with respect to Existing Conditions for the Trinity River (up to 49%) and the American River at Nimbus Dam (up to 292%) and at the confluence with the Sacramento River (up to 270%) that would increase river lamprey ammocoete stranding risk and therefore rearing success for these locations. There would be a beneficial effect from reduced occurrence of flow reductions in the Feather River (up to 61% reduction) but this effect would not be sufficient to offset the negative effects from increased occurrence of flow reductions at the other locations. Further, stranding risk under H4_ELT in the Feather River would be higher than those under H3_ELT, such that the benefits under H3_ELT would not occur under these H4_ELT. There would also be increases under Alternative 4A in ammocoete cohort exposure to critical water temperatures in the Feather and American rivers that would have effects on rearing success through ammocoete mortality. Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce rearing habitat and substantially reduce the number of river lamprey as a result of fry and juvenile mortality.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of the results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, project-related effects on flow reductions and effects on water temperatures in all locations analyzed would be negligible and would not affect river lamprey ammocoete stranding risk and rearing success. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in flows and water temperatures under Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, the impact is less than significant and no mitigation is required.

Impact AQUA-186: Effects of Water Operations on Migration Conditions for River Lamprey

In general, the effect of Alternative 4A on river lamprey migration conditions would be negligible relative to the NAA_ELT.

H3_ELT/ESO_ELT

After 3 to 5 years, river lamprey ammocoetes migrate downstream and become macropthalmia once they reach the Delta. River lamprey migration generally occurs September through November (USFWS unpublished data). The effects of H3_ELT on seasonal migration flows for river lamprey macropthalmia were assessed using CALSIM II flow output. Flow rates along the likely migration pathways of river lamprey during the likely migration period (September through November) were examined to predict how H3_ELT may affect migration flows for outmigrating macropthalmia. Analyses were conducted for the Sacramento River at Red Bluff, Feather River at the confluence with the Sacramento River, and the American River at the confluence with the Sacramento River.

The adult river lamprey upstream migration period also occurs between September and June. Therefore, results presented below represent effects to the migration of both macropthalmia and adult river lamprey. CALSIM II flow outputs were examined during these periods for each model scenario.

Sacramento River

Mean monthly flow rates for the Sacramento River at Red Bluff (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) were examined during the September to November river lamprey macropthalmia and adult migration periods. Flows under H3_ELT would generally be similar to or up to 18% lower than flows under NAA_ELT during September and November and similar to flows under NAA_ELT during October. Because of the relatively small magnitude, reduced flows during November are not likely to cause biologically meaningful effects on river lamprey migration.

Feather River

Flows in the Feather River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) were examined during the September to November river lamprey macropthalmia and adult migration periods. Flows under H3_ELT would generally be up to 27% lower than flows under NAA_ELT during September, up to 17% higher than flows under NAA_ELT during October, and similar to flows under NAA_ELT during November. Based on occurrence of negligible effects or increases in flow that would have a beneficial effect on migration conditions, with decreases predicted for wetter water years when effects on migration conditions would not be as critical, these results indicate that effects of NAA_ELT on flows would not have biologically meaningful negative effects on migration conditions in the Feather River.

American River

Flows in the American River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) were examined during the September through November macropthalmia and adult migration periods. Flows under H3_ELT would be lower than flows under NAA_ELT during September and November and similar to flows during October. These results indicate that project-related effects would include small to moderate decreases in flow under H3_ELT for some months and water year types.

H4_ELT/HOS

Flows under H4_ELT in the Sacramento River at Red Bluff would be similar to flows under NAA_ELT during September and October and up to 15% lower during November (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H4_ELT in the Feather River at the confluence with the Sacramento River would generally be up to 38% lower than flows under H3_ELT in September and mixed (higher, lower, and similar) during October and November. Flows under H4_ELT in the American River at the confluence with the Sacramento River would generally be lower than those under NAA_ELT but up to 22% during September and November and similar during October. These results indicate that project-related effects would include small to moderate decreases in flow under H4_ELT for some months and water year types.

NEPA Effects: Collectively, these modeling results indicate that the effect is not adverse because it would not substantially reduce the amount of suitable habitat or substantially interfere with the movement of fish. H3_ELT would primarily have negligible effects (<5%), small increases or decreases in flow, or decreases in wetter water year types and/or during a limited portion of the migration period that would not have negative effects on migration conditions. There would be beneficial effects from moderate increases in flow for some months and water year types in the Feather River (to 34%) and American River (to 24%); however, the beneficial effect would be partially offset by flow reductions during other months of the migration periods. Flows under H4_ELT would be similar to those under H3_ELT.

CEQA Conclusion: In general, Alternative 4A would reduce the quantity and quality of migration habitat for river lamprey relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, reviewing the alternative's impacts in relation to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demand. Informed by the NAA_ELT comparison, Alternative 4A would not affect the quantity and quality of migration habitat for river lamprey.

H3_ELT/ESO_ELT

For the Sacramento River at Red Bluff, comparisons of mean monthly flow rate for H3_ELT to Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) indicate that flows under H3_ELT would be up to 22% lower than those under Existing Conditions during October and November. During September, flows would be higher in wetter years and lower in drier years.

Comparisons for the Feather River at the confluence with the Sacramento River indicate (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) indicate highly variable effects of H3_ELT relative to Existing Conditions depending on month and water year type. Combining all water year types, flows would be 28% higher during September, 8% lower during October, and 5% lower during November.

Comparisons for the American River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) for September through November indicate reductions in flows in September and November of up to 47% and variable changes of 11% lower to 15% higher during October depending on water year type. Overall, these results show that flows would be reduced in the American River during this period relative to Existing Conditions.

H4_ELT/HOS

Flows under H4_ELT in the Sacramento River at Red Bluff would be similar to or greater than flows under Existing Conditions during September through November, although highly variable during September (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H4_ELT in the Feather River at the confluence with the Sacramento River would be higher and lower than flows under Existing Conditions depending on month and water year type, but lower overall. Flows under H4_ELT in the American River at the confluence with the Sacramento River would generally be up to 47% lower than flows under Existing Conditions. Overall, migration conditions for river lamprey under H4_ELT would be less favorable than conditions under Existing Conditions.

Summary of CEQA Conclusion

Under Alternative 4A, there would be moderate and persistent flow reductions for substantial portions of the river lamprey macropthalmia migration period in the American River, and less persistent and smaller magnitude flow reductions in the Sacramento River and Feather River. These flow reductions would affect juvenile migration success, increase straying, and delay access to the ocean. If in fact, lamprey use these cues to find natal spawning grounds, these flow reductions may also affect adult migration success, including a reduction in the ability for adults to sense olfactory cues. There would be beneficial effects from increases in flow for some months and water year types in each location. However, this effect would not be sufficient to offset the negative effects of flow reductions for the remainder of the migration period and/or in other water year types, particularly drier water year types when effects of flow reductions would be more critical. Flows under H4_ELT would be less favorable than those under H3_ELT. Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce migration conditions for river lamprey.

However, this interpretation of the biological modeling is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison in results between the alternative and NAA_ELT, is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, there would generally be negligible effects on mean monthly flow and water temperatures for river lamprey migration periods at all locations analyzed. Therefore, this impact is less than significant and no mitigation is required,

Restoration Measures (Environmental Commitment Environmental Commitment 4, Environmental Commitment 6, Environmental Commitment 7, and Environmental Commitment 10)

The discussion of the effects of restoration measures for Pacific lamprey is also applicable to river lamprey.

Impact AQUA-187: Effects of Construction of Restoration Measures on River Lamprey

Refer to Impact AQUA-169 under Pacific lamprey for a discussion of the effects of construction of restoration measures on river lamprey.

NEPA Effects: The effects of short-term construction activities would not be adverse to river lamprey because environmental commitments would limit the potential for construction-related effects.

CEQA Conclusion: As discussed for Alternative 1A, habitat restoration activities could result in short-term effects on river lamprey but would be localized, sporadic, and of low magnitude; such effects would be avoided by limiting the frequency, duration, and spatial extent of in-water work and with implementation of environmental commitments (see Appendix 3B, *Environmental Commitments*). The potential impact of habitat restoration activities is considered less than significant because it would not substantially reduce river lamprey habitat, restrict its range, or interfere with its movement. No additional mitigation would be required.

Impact AQUA-188: Effects of Contaminants Associated with Restoration Measures on River Lamprey

Refer to Impact AQUA-169 under Pacific lamprey for a discussion of the effects of contaminants associated with restoration measures on river lamprey, which are assumed to have similar potential for exposure and effects of exposure for contaminant-related effects.

NEPA Effects: As noted for other covered fishes, while Alternative 4A habitat restoration actions may result in a very small increase production, mobilization, and bioavailability of methylmercury, selenium, copper, and pesticides in the aquatic system, any such releases would be short-term and localized, and would be unlikely to result in measurable increases in the bioaccumulation of these contaminants in river lamprey. Overall, the effects of contaminants associated with restoration measures would not be adverse for river lamprey.

CEQA Conclusion: As noted for other covered fishes, habitat restoration under Alternative 4A may result in increased production, mobilization, and bioavailability of contaminants in the aquatic system, but these would be short-term and localized, and would be unlikely to result in measurable increases in the bioaccumulation in river lamprey. For methylmercury, implementation of *Environmental Commitment 12 Methylmercury Management* would help to minimize the increased mobilization of methylmercury in the limited restoration areas. Therefore, the impact of contaminants is considered less than significant because it would not substantially affect river lamprey either directly or through habitat modifications. Consequently, no mitigation would be required.

Impact AQUA-189: Effects of Restored Habitat Conditions on River Lamprey

Refer to Impact AQUA-170 under Pacific lamprey for a discussion of the effects of restored habitat conditions on river lamprey.

NEPA Effects: The effects of restored habitat conditions on river lamprey would not be adverse because restoration could provide habitat benefits for lamprey.

CEQA Conclusion: As described in the discussion for Pacific lamprey, habitat restoration would be undertaken to offset loss/modification of habitat from water facility construction and operation. The effects of restored habitat conditions on river lamprey would be less than significant. Consequently, no mitigation would be required.

Other Environmental Commitments (Environmental Commitment 12, Environmental Commitment 15, and Environmental Commitment 16)

The discussion of the effects of other conservation measures for Pacific lamprey is also applicable to river lamprey.

Impact AQUA-190: Effects of Methylmercury Management on River Lamprey (Environmental Commitment 12)

Refer to Impact AQUA-46 under winter-run Chinook salmon for a discussion of the effects of methylmercury management on river lamprey.

NEPA Effects: The effects of methylmercury management on river lamprey would not be adverse because it is expected to reduce overall methylmercury levels resulting from habitat restoration.

CEQA Conclusion: As noted for winter-run Chinook salmon, effects of *Environmental Commitment 12 Methylmercury Management* within the areas restored under Alternative 4A are expected to reduce overall methylmercury levels resulting from habitat restoration. Because it is designed to improve water quality and habitat conditions, impacts on river lamprey would be less than significant. Consequently, no mitigation is required.

Impact AQUA-193: Effects of Localized Reduction of Predatory Fish on River Lamprey (Environmental Commitment 15)

Refer to Impact AQUA-175 under Pacific lamprey for a discussion of the effects of predator management on river lamprey.

NEPA Effects: Consistent with the analysis for Alternative 1A and reflecting the above discussion for Pacific lamprey, which is expected to have similar predators, the overall effect would not be adverse.

CEQA Conclusion: Consistent with the analysis for Alternative 1A and reflecting the discussion for Pacific lamprey, the impact is considered less than significant. Consequently, no mitigation would be required.

Impact AQUA-194: Effects of Nonphysical Fish Barriers on River Lamprey (Environmental Commitment 16)

Refer to Impact AQUA-176 under Pacific lamprey for a discussion of the effects of nonphysical fish barriers on river lamprey.

NEPA Effects: The overall effect of the NPB on Pacific lamprey would not be adverse because of their limited hearing ability in the range employed by the NPB's acoustic deterrence stimuli.

CEQA Conclusion: Consistent with the analysis for Alternative 1A and reflecting the above discussion, the impact of the NPB on Pacific lamprey is considered less than significant because of their limited hearing ability in the range employed by the NPB's acoustic deterrence stimuli. Consequently, no mitigation would be required.

Non-Covered Aquatic Species of Primary Management Concern

Construction and Maintenance of Water Conveyance Facilities

The effects of construction and maintenance of the water conveyance facilities under Alternative 4A would be similar in nature for all non-covered species; therefore, the analysis below is combined for all non-covered species instead of analyzed by individual species.

Impact AQUA-199: Effects of Construction of Water Conveyance Facilities on Non-Covered Aquatic Species of Primary Management Concern

NEPA Effects: Refer to Impact AQUA-1 under delta smelt for a discussion of the types of effects of construction of water conveyance facilities that are relevant to non-covered species of primary management concern. That discussion under delta smelt addresses the type, magnitude and range of impact mechanisms that are relevant to the aquatic environment and aquatic species. The potential effects of the construction of water conveyance facilities under Alternative 4A would the same as those for Alternative 4. Implementation of the measures described in Appendix 3B, *Environmental Commitments*, such as *Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue and Salvage Plan*; and *Barge Operations Plan* would guide rapid and effective response in the case of inadvertent spills of hazardous materials. Construction would not be expected to increase predation rates relative to baseline conditions. Construction will result in both temporary and permanent alteration of rearing and migratory habitats. However, Alternative 4A includes Environmental Commitment 4 to restore tidal habitat and Environmental Commitment 6 to restore channel margin habitat. The direct effects of underwater construction noise on species that may be present could be adverse if they are exposed. However, implementation of Mitigation Measures AQUA-1a and AQUA-1b, combined with the in-water work window that would minimize exposure, would reduce the potential for effects from underwater noise and this effect would not be adverse.

Consistent with the conclusion for Alternative 4, Impact AQUA-1, environmental commitments and mitigation measures would be available to avoid and minimize potential effects, and the effect would not be adverse for non-covered aquatic species of primary management concern.

CEQA Conclusion: Consistent with the conclusion for Alternative 4, Impacts AQUA-1 and AQUA-199, the impact of the construction of the water conveyance facilities on non-covered aquatic species of primary management concern would not be significant except for construction noise associated with pile driving. Construction of Alternative 4A involves several elements with the potential to affect these fish species. However, these turbidity and hazardous material spill effects will be effectively avoided and/or minimized through implementation of environmental commitments (see Impact AQUA-1 and Appendix 3B, *Environmental Commitments*: *Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue and Salvage Plan*; and *Barge Operations Plan*). Implementation of Mitigation Measures AQUA-1a and AQUA-1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Impact AQUA-200: Effects of Maintenance of Water Conveyance Facilities on Non-Covered Aquatic Species of Primary Management Concern

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 4A would be the same as those described for Alternative 4 (which draws on the analysis of Alternative 1A, Impact AQUA-2). California bay shrimp would not be affected because they do not occur in the vicinity and Sacramento-San Joaquin roach and hardhead are unlikely to be affected because their primary distributions are upstream. Consequently, the effects would not be adverse.

CEQA Conclusion: Consistent with the conclusion for Alternative 4, Impact AQUA-2 and Impact AQUA-200, the impact of the maintenance of water conveyance facilities on non-covered species of primary management concern would be less than significant and no mitigation is required.

Operations of Water Conveyance Facilities

The effects of water operations of the water conveyance facilities under Alternative 4A include a detailed analysis of the following species.

- Striped bass
- American shad
- Threadfin shad
- Largemouth bass
- Sacramento tule perch
- Sacramento-San Joaquin roach – California species of special concern
- Hardhead – California species of special concern

Impact AQUA-201: Effects of Water Operations on Entrainment of Non-Covered Aquatic Species of Primary Management Concern

A revised analysis of Impact AQUA-201 for all alternatives, including Alternative 4A, is provided in Chapter 11, Section 11.3.5, in Appendix A. The analysis below for Alternative 4A draws on that analysis.

Striped Bass

NEPA Effects: Under Existing Conditions, striped bass are observed in salvage operations of the south Delta facilities throughout the year, with the majority of juvenile striped bass entrainment occurring during the summer (May through July). As described in Chapter 11, Section 11.3.5, in Appendix A, operation of the north Delta intakes under Alternative 4A would be expected to reduce overall entrainment of screenable life stages (i.e., early juveniles and older, around 20 mm long) because of the reduction in use of the south Delta facilities, which do not have the state of the art fish screens proposed for the north Delta intakes. Differences in potential entrainment as a function of exports that were provided for juvenile Sacramento splittail under Impact AQUA-111 are representative of the late spring/early summer reductions in entrainment that could occur for juvenile striped bass. As described in Chapter 11, Section 11.3.5, in Appendix A, eggs and larval striped bass are susceptible to entrainment at the proposed north Delta intakes. Particle tracking modeling results for ten monthly periods during March-June suggested that overall entrainment of eggs and larvae of striped bass originating in the Sacramento River upstream of the Delta and moving downstream into the Delta would increase relative to NAA_ELT (see Table 11-mult-5 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS). For Alternative 4A, scenario H3_ELT, the mean entrainment was increased from 6.5% of particles to 21% of particles, a 220% increase. Note that entrainment of the early life stages of striped bass at the north Delta intakes may be moderated by real-time operational adjustments being made under Alternative 4A during the spring to benefit covered fishes such as spring-run Chinook salmon, and that the results presented in Table 11-mult-5 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS for Alternative 4A reflect the H3_ELT scenario, whereas spring entrainment under the H4_ELT scenario would be somewhat less. Note also that although the north Delta intake screens are estimated to include larvae or juvenile fish of around 20-22 mm and larger, they may also exclude smaller fish to some extent, based on observations from other fish screens in the Delta (Nobriga et al. 2004). As described in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS, density-dependence during the juvenile stages of the striped bass life cycle means that losses of early life stages do not necessarily translate into proportional reductions in abundance of older individuals, and entrainment has not recently been identified as a significant driver of juvenile abundance (Mac Nally et al. 2010; Thomson et al. 2010). Therefore it is concluded with some uncertainty that there would be an adverse effect on striped bass.

CEQA Conclusion: The impact of water operations on entrainment of striped bass would be similar to the effects described immediately above. Relative to Existing Conditions, particle tracking modeling for Alternative 4A scenario H3_ELT showed mean entrainment was increased by around 160% (from 8% to 21%; Table 11-mult-5 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS). As described in the NEPA Effects section above, increased losses of striped bass eggs and larvae need not necessarily translate into reductions in abundance of later life stages. Nevertheless, there is no feasible mitigation that would reduce this potential impact. Thus, this impact is significant and unavoidable.

American Shad

As described for Alternative 4, American shad eggs and larvae would be vulnerable to entrainment at the proposed north SWP/CVP Delta intakes as these life stages are passively transported downstream to the north Delta. Most American shad spawning though takes place well upstream of the Delta and juveniles may rear to sufficiently large size to avoid entrainment as state-of-the-art fish screens on the proposed north Delta intakes would exclude juvenile and adult American shad.

NEPA Effects: Differences in potential entrainment as a function of exports that were provided for juvenile Sacramento splittail under Impact AQUA-111 are representative of the late spring/early summer reductions in entrainment that could occur for juvenile American shad. As described in Chapter 11, Section 11.3.5, in Appendix A, eggs and larval American shad are susceptible to entrainment at the proposed north Delta intakes. Particle tracking modeling results for ten monthly periods during March-June suggested that overall entrainment of eggs and larvae of American shad originating in the Sacramento River upstream of the Delta and moving downstream into the Delta would increase relative to NAA_ELT (see Table 11-mult-5 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS). For Alternative 4A, scenario H3_ELT, and as discussed above for striped bass, the mean entrainment was increased from 6.5% of particles to 21% of particles, a 220% increase. As noted for striped bass, entrainment of the early life stages of American shad at the north Delta intakes may be moderated by real-time operational adjustments being made under Alternative 4A during the spring to benefit covered fishes such as spring-run Chinook salmon; in addition, the results presented in Table 11-mult-5 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS for Alternative 4A reflect the H3_ELT scenario, whereas spring entrainment under the H4_ELT scenario would be somewhat less. Note also that although the north Delta intake screens are estimated to include larvae or juvenile fish of around 20-22 mm and larger, they may also exclude smaller fish to some extent, based on observations from other fish screens in the Delta (Nobriga et al. 2004). As described in Chapter 11, Section 11.3.5, in Appendix A, although American shad early life stages may rear to sufficiently large size above the Delta to avoid entrainment, they could also be entrained in appreciably greater magnitude than currently occurs and therefore it is also concluded that the effects of entrainment on American shad would be adverse.

CEQA Conclusion: The impact of water operations on entrainment of American shad would be similar to the effects described immediately above. Relative to Existing Conditions and as described above for striped bass, particle tracking modeling for Alternative 4A scenario H3_ELT showed mean entrainment was increased by around 160% (from 8% to 21%; Table 11-mult-5 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS). As described in the NEPA Effects section above, American shad early life stages may rear to sufficiently large size above the Delta to avoid entrainment. Nevertheless, there is no feasible mitigation that would reduce this potential impact. Thus, this impact is significant and unavoidable to American shad.

Threadfin Shad

NEPA Effects: The impact and conclusion would be the same as discussed for Alternative 1A (Impact AQUA-201 for Threadfin Shad). Entrainment at the south delta would be reduced due to overall decreased exports from the SWP/CVP south Delta facilities. Entrainment losses would be further reduced under Scenario H4 compared to the other flow scenarios for Alternative 4A. There would be potential entrainment of threadfin shad eggs and larvae to the north Delta intakes, although this risk is minimal because threadfin shad are most abundant in the south Delta (Baxter et al. 2010; see also discussion in Chapter 11, Section 11.3.5, in Appendix A). Overall, threadfin shad entrainment would be reduced because they are most abundant in the southern Delta and would particularly benefit from reduced south Delta exports. The effect would not be adverse.

CEQA Conclusion: The impact of water operations on entrainment of threadfin shad would be similar to the effects described immediately above in the NEPA Effects section. The impact would be less than significant and no mitigation would be required.

Largemouth Bass

NEPA Effects: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The effect would not be adverse.

CEQA Conclusion: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The impact would be less than significant and no mitigation would be required.

Sacramento Tule Perch

NEPA Effects: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The effect would not be adverse.

CEQA Conclusion: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The impact would be less than significant and no mitigation would be required.

Sacramento-San Joaquin Roach

NEPA Effects: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The effect would not be adverse.

CEQA Conclusion: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The impact would be less than significant and no mitigation would be required.

Hardhead

NEPA Effects: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The effect would not be adverse.

CEQA Conclusion: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The impact would be less than significant and no mitigation would be required.

California Bay Shrimp

NEPA Effects: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The effect would not be adverse.

CEQA Conclusion: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The impact would be less than significant and no mitigation would be required.

Impact AQUA-202: Effects of Water Operations on Spawning and Egg Incubation Habitat for Non-Covered Aquatic Species of Primary Management Concern

See Alternative 1A, Impact AQUA-202 for additional background information relevant to non-covered species of primary management concern.

Striped Bass

In general, the effects of Alternative 4A on the quality and quantity of spawning, egg incubation, and initial rearing habitat conditions for striped bass would not be adverse relative to the NAA_ELT.

H3_ELT/ESO_ELT

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through June striped bass spawning, embryo incubation, and initial rearing period. Lower flows could reduce the quantity and quality of instream habitat available for spawning, egg incubation, and rearing.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or slightly greater than flows under NAA_ELT during April through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to flows under NAA_ELT during April through June, except in above normal years during April (17% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT during April through June regardless of water year type (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would generally be moderately to substantially greater than flows under NAA_ELT during April through June, except in critical years during May (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows under NAA_ELT during April through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT during April through June, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would be similar to those under NAA_ELT during April through June, regardless of water year type.

Water Temperature

The percentage of months outside of the 59°F to 68°F suitable water temperature range for striped bass spawning, embryo incubation, and initial rearing during April through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success and increased egg and larval stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT outside the range would be similar to or lower than the percentage under NAA_ELT in all water year types (Table 11-4A-138).

Table 11-4A-138. Difference and Percent Difference in the Percentage of Months during April–June in Which Water Temperatures in the Feather River below Thermalito Afterbay are outside the 59°F to 68°F Water Temperature Range for Striped Bass Spawning, Embryo Incubation, and Initial Rearing[a]

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	0 (0%)	-5 (-10%)
Above Normal	-3 (-7%)	-13 (-24%)
Below Normal	-14 (-33%)	-16 (-36%)
Dry	0 (0%)	-10 (-18%)
Critical	8 (21%)	-3 (-6%)
All	-2 (-5%)	-9 (-18%)

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through June striped bass spawning, embryo incubation, and initial rearing period would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be similar to or up to 548% greater than flows under NAA_ELT during April through June, except in June of wet and critical water years, when the flow would be 12% and 10% lower, respectively, than flow under NAA_ELT.

Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under NAA_ELT during April through June, except for 10% higher flow during April of critical water years, 14% lower flow for May of critical years, and 10% lower flow for June of dry years.

Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under NAA_ELT during April through June, except for 17% lower flow during April of above normal water years.

Flows under H4_ELT in the San Joaquin and Stanislaus Rivers and in Clear Creek would be similar to flows under NAA_ELT throughout the period.

The percentage of months under H4_ELT with mean water temperatures outside the 59°F to 68°F suitable water temperature range in the Feather River below Thermalito Afterbay would be 10% higher than the percentage under NAA_ELT in wet years, 11% and 7% lower than the percentage under NAA_ELT in below normal and dry water years, respectively, and would be the same as the percentage under NAA_ELT in above normal and critical water years (Table 11-4A-139). Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H4_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. Water temperature modeling was not conducted in Clear Creek or the San Joaquin River.

Table 11-4A-139. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in the Percentage of Months during April–June in which Water Temperatures in the Feather River below Thermalito Afterbay are Outside the 59°F to 68°F Water Temperature Range for Striped Bass Spawning, Embryo Incubation, and Initial Rearing[a]

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	10 (23%)	5 (10%)
Above Normal	10 (22%)	0 (0%)
Below Normal	-3 (-7%)	-5 (-11%)
Dry	6 (13%)	-4 (-7%)
Critical	11 (28%)	0 (0%)
All	7 (16%)	0 (0%)

[a] A negative value indicates a reduction in percentage of months outside suitable range for H4_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 4A would not cause a substantial reduction in striped bass spawning, incubation, or initial rearing habitat. Flows in all rivers examined during the April through June spawning, incubation, and initial rearing period under Alternative 4A would generally be similar to or greater than flows under the NAA_ELT. There would be no substantial temperature effects under Alternative 4A in any river examined. Flow and water temperature conditions under H4_ELT would be less favorable than those under H3_ELT, but would be similar to those under NAA_ELT.

CEQA Conclusion: In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions for striped bass relative to Existing Conditions.

H3_ELT/ESO_ELT

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through June striped bass spawning, embryo incubation, and initial rearing period. Lower flows could reduce the quantity and quality of instream habitat available for spawning, egg incubation, and rearing.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during April through June, except in wet years during May (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during April through June, except in critical years during May (6% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows under Existing Conditions during April through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under Existing Conditions during April through June, except in below normal years in April (6% lower) and wet years during May (15% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to flows under Existing Conditions during April and June, but lower during May (16% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly lower than those under Existing Conditions during April through June, with few exceptions.

In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would generally be up to 14% lower than to those under Existing Conditions during April through June, except during wet years, in which flow would range from 0.3% lower in April to 11% greater in June.

Water Temperature

The percentage of months outside of the 59°F to 68°F suitable water temperature range for striped bass spawning, embryo incubation, and initial rearing during April through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers.

Water temperatures outside this range could lead to reduced spawning success and increased egg and larval stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under Existing Conditions, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers.

In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT outside of the 59°F to 68°F suitable water temperature range for striped bass spawning, embryo incubation, and initial rearing during April through June would be the same as or lower than the percentage under Existing Conditions in all water years except critical years (21% higher on a relative scale; 8% higher on an absolute scale) (Table 11-4A-138). This is a relatively small effect that would not have biologically meaningful negative effects on the striped bass population because it only occurs in one water year type.

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through June striped bass spawning, embryo incubation, and initial rearing period would generally be similar to flows under Existing Conditions, except during May of wet years when flows would be 11% lower under H4_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be up to 509% greater than flows under Existing Conditions during April through June, except during June of wet and critical water years, when flow under H4_ELT would be 37% lower and 6% lower, respectively.

Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under Existing Conditions during April, and generally up to 27% lower than flows under Existing Conditions during May and June.

Flows under H4_ELT in the San Joaquin River at Vernalis would generally be similar to or slightly lower than those under Existing Conditions during April through June, except for June of wet and dry water years, when flows under H3_ELT would be 16% and 12% lower, respectively.

Flows under H4_ELT in the Stanislaus River at the confluence with the San Joaquin River would generally be up to 14% lower than to those under Existing Conditions during April through June, except during wet years, in which flow would range from 0.3% lower in April to 11% greater in June.

Flows under H4_ELT in the Trinity River and Clear Creek would be similar to flows under Existing Conditions throughout the period, with minor exceptions.

The percentage of months under H4_ELT with mean water temperatures outside the 59°F to 68°F suitable water temperature range in the Feather River below Thermalito Afterbay would be similar or up to 28% higher than the percentage under Existing Conditions depending on water year type (Table 11-4A-139). Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H4_ELT would generally be the same as those under Existing Conditions, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers.

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the impact would not be significant because Alternative 4A would not cause a substantial reduction in spawning, incubation, and initial rearing habitat of striped bass relative to Existing Conditions. Therefore, no mitigation is necessary. Flows in all rivers except the San Joaquin and Stanislaus Rivers during the April through June spawning, incubation, or initial rearing period under Alternative 4A would generally be similar to or greater than flows under Existing Conditions. There would be isolated and/or small-magnitude flow reductions for some months and water year types in the San Joaquin and Stanislaus Rivers that would not have biologically meaningful negative effects to striped bass. There would be no substantial temperature effects under Alternative 4A on striped bass. Flow and water temperature conditions under H4_ELT would be less favorable than those under H3_ELT, but would be similar to those under Existing Conditions.

American Shad

In general, the effects of Alternative 4A on the quality and quantity of spawning and egg incubation habitat conditions for American shad would not be adverse relative to the NAA_ELT.

H3_ELT/ESO_ELT

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through June American shad adult migration and spawning period. Lower flows could reduce migration ability and instream habitat quantity and quality for spawning.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT during April through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to flows under NAA_ELT during April through June, except in above normal years during April (17% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT during April through June, regardless of water year type (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3 would generally be moderately to substantially greater than flows under NAA during April through June, except in critical years during May (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows under NAA_ELT during April through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT during April through June, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River flows under H3_ELT would be similar to those under NAA_ELT during April through June, regardless of water year type.

Water Temperature

The percentage of months outside of the 60°F to 70°F water temperature range for American shad adult migration and spawning during April through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success and increased adult migrant stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT outside the 60°F to 70°F water temperature range would be lower than the percentage under NAA_ELT regardless of water year type (Table 11-4A-140).

Table 11-4A-140. Difference and Percent Difference in the Percentage of Months during April–June in Which Water Temperatures in the Feather River below Thermalito Afterbay Are outside the 60°F to 70°F Water Temperature Range for American Shad Adult Migration and Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	-6 (-13%)	-2 (-5%)
Above Normal	-3 (-8%)	-15 (-31%)
Below Normal	-2 (-6%)	-7 (-19%)
Dry	-2 (-5%)	-4 (-10%)
Critical	-3 (-8%)	-6 (-15%)
All	-4 (-10%)	-6 (-15%)

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through June American Shad migration and spawning period would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be similar to or up to 548% greater than flows under NAA_ELT during April through June, except in June of wet and critical water years, when the flow would be 12% and 10% lower, respectively, than flows under NAA_ELT.

Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under NAA_ELT during April through June, except for 10% higher flow during April of critical water years, 14% lower flow for May of critical years, and 10% lower flows for June of dry years.

Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under NAA_ELT during April through June, except for 17% lower flow during April of above normal water years.

Flows under H4_ELT in the San Joaquin and Stanislaus Rivers and in Clear Creek would be similar to flows under NAA_ELT throughout the period.

The percentage of months under H4_ELT with mean water temperatures outside the 60°F to 70°F suitable water temperature range in the Feather River below Thermalito Afterbay would be up to 10% higher and up to 8% lower on a relative scale than the percentage under NAA_ELT, in depending on water year type (Table 11-4A-141). On an absolute scale, these differences would be very small (≤4%) and, therefore, would not be biologically meaningful to American shad.

Table 11-4A-141. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in the Percentage of Months during April–June in Which Water Temperatures in the Feather River below Thermalito Afterbay Are outside the 60°F to 70°F Water Temperature Range for American Shad Adult Migration and Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	0 (0%)	4 (10%)
Above Normal	16 (44%)	4 (8%)
Below Normal	2 (6%)	-3 (-8%)
Dry	2 (5%)	0 (0%)
Critical	0 (0%)	-3 (-8%)
All	3 (8%)	1 (2%)

[a] A negative value indicates a reduction in percentage of months outside suitable range for H4_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 4A would not cause a substantial reduction in American shad spawning or adult migration. Flows in all rivers examined during the April through June adult migration and spawning period under Alternative 4A would generally be similar to or greater than flows under the NAA_ELT. There would be no substantial temperature effects under Alternative 4A in any river examined. Flow and water temperature conditions under H4_ELT would be less favorable than those under H3_ELT, but would be similar to those under NAA_ELT.

CEQA Conclusion: In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions for American shad relative to Existing Conditions.

H3_ELT/ESO_ELT

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through June American shad adult migration and spawning period. Lower flows could reduce migration ability and instream habitat quantity and quality for spawning.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during April through June, except in wet years during May (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during April through June, except in critical years during May (6% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows under Existing Conditions during April through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under Existing Conditions during April through June, except in below normal years in April (6% lower) and wet years during May (15% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to flows under Existing Conditions during April and June, but lower during May (16% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly lower than those under Existing Conditions during April through June.

In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would generally be up to 14% lower than to those under Existing Conditions during April through June, except during wet years, in which flow would range from 0.3% lower in April to 11% greater in June.

Water Temperature

The percentage of months outside of the 60°F to 70°F water temperature range for American shad adult migration and spawning during April through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success and increased adult migrant stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT outside of the 60°F to

70°F water temperature range would be lower than the percentage under Existing Conditions in all water year types (Table 11-4A-140).

H4_ELT /HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through June American Shad migration and spawning period would generally be similar to flows under Existing Conditions, except during May of wet years when flows would be 11% lower under H4_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be up to 509% greater than flows under Existing Conditions during April through June, except during June of wet and critical water years, when flow under H4_ELT would be 37% lower and 6% lower, respectively.

Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under Existing Conditions during April, and up to 27% lower than flows under Existing Conditions during May and June.

Flows under H4_ELT in the San Joaquin River at Vernalis would generally be similar to or slightly lower than those under Existing Conditions during April through June, except for June of wet and dry water years, when flows under H4_ELT would be 16% and 12% lower, respectively.

Flows under H4_ELT in the Stanislaus River at the confluence with the San Joaquin River would generally be up to 14% lower than to those under Existing Conditions during April through June, except during wet years, in which flow would range from 0.3% lower in April to 11% greater in June.

Flows under H4_ELT in the Trinity River and Clear Creek would be similar to flows under Existing Conditions throughout the period, with minor exceptions. The percentage of months under H4_ELT with mean water temperatures outside the 60°F to 70°F suitable water temperature range in the Feather River below Thermalito Afterbay would be similar to the percentage under Existing Conditions in all water types except above normal water years, for which the percentage under H4_ELT would be 44% higher (Table 11-4A-141). Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers.

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the impact would not be significant because Alternative 4A would not cause a substantial reduction in American shad adult migration and spawning habitat relative to Existing Conditions, and no mitigation is necessary. Flows in all rivers examined except the San Joaquin and Stanislaus Rivers during the April through June adult migration and spawning period under Alternative 4A would generally be similar to or greater than flows under Existing Conditions. There would be isolated and/or small-magnitude flow reductions for some months and water year types in the San Joaquin and Stanislaus Rivers that would not have biologically meaningful negative effects. There would be no temperature related effects of Alternative 4A on American shad. Flow and water temperature conditions under H4_ELT would be less favorable than those under H3_ELT, but would be similar to those under Existing conditions.

Threadfin Shad

In general, the effects of Alternative 4A on the quality and quantity of spawning habitat conditions for threadfin shad would not be adverse relative to the NAA_ELT.

H3_ELT/ESO_ELT

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during April through August threadfin shad spawning period. Lower flows could reduce the quantity and quality of instream habitat available for spawning.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT during April through August, except in dry years during August (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to flows under NAA_ELT during April through August, except in above normal years during April (17% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT during April through August, except in critical years during July (14% lower) and in critical years during August (11% greater) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would be moderately to substantially greater than flows under NAA_ELT during April through June (to 106% greater), except during critical years in May (10% lower) and June (8% lower), and moderately to substantially lower than flows under NAA_ELT during July and August (to 48% lower), except during critical years in August (23% greater) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Based on occurrence late in the spawning period, these flow reductions are not expected to have biologically meaningful effects.

In the American River below Nimbus Dam, flows under H3_ELT would be similar to or greater than flows under NAA_ELT during April through July and lower than flows under NAA_ELT during August (to 21% lower) regardless of water year type (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). These flow reductions are small to moderate in magnitude and limited to late in the spawning period and, therefore, would not have biologically meaningful negative effects.

In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT during April through August, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would be similar to those under NAA_ELT during April through August, regardless of water year type.

Water Temperature

The percentage of months below 68°F water temperature threshold for the April through August adult threadfin shad spawning period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures below this threshold could delay or prevent successful spawning in these areas. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT below 68°F would be greater than those under NAA_ELT (4% to 25% greater) in all but dry and critical years (Table 11-4A-142). On an absolute scale, these are small increases (≤4%) that would not have biologically meaningful effects, except in below normal water years (14% increase).

Table 11-4A-142. Difference and Percent Difference in the Percentage of Months during April–August in Which Water Temperatures in the Feather River below Thermalito Afterbay fall below the 68°F Water Temperature Threshold for Threadfin Shad Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	1 (1%)	2 (4%)
Above Normal	-9 (-12%)	4 (6%)
Below Normal	1 (2%)	14 (25%)
Dry	-26 (-34%)	-2 (-4%)
Critical	-22 (-33%)	-2 (-4%)
All	-10 (-14%)	3 (5%)

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through August threadfin shad spawning period would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under NAA_ELT during April through August, except for 17% lower flow during April of above normal water years.

Flows under H4_ELT in Clear Creek below Whiskeytown would generally be similar to flows under NAA_ELT during April through August, except for 14% lower flow during July of critical water years and 11% higher flow in August of critical years.

Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be up to 548% greater than flows under NAA_ELT during April through June, except for 10% lower and 12% lower flows during June of critical and wet years, respectively, and would be up to 46% lower than flows under NAA_ELT during July and August, except for 48% higher flows in August of critical water years. Based on occurrence late in the spawning period, these flow reductions are not expected to have biologically meaningful effects.

Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under NAA_ELT during April through August, except for 14% lower flow in May of critical water years, 28% lower flow in August of critical years, and 18% greater flow in August of below normal water years.

Flows under H4_ELT in the San Joaquin and Stanislaus Rivers would be similar to flows under NAA_ELT throughout the period.

The percentage of months under H4_ELT with mean water temperatures below the 68°F temperature threshold in the Feather River below Thermalito Afterbay would be similar to or lower than the percentage under NAA_ELT in all water years (Table 11-4A-143). Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H4_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. Water temperature modeling was not conducted in Clear Creek or the San Joaquin River.

Table 11-4A-143. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in the Percentage of Months during April–June in Which Water Temperatures in the Feather River below Thermalito Afterbay fall below the 68°F Water Temperature Threshold for Threadfin Shad Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	-7 (-11%)	-5 (-9%)
Above Normal	-27 (-36%)	-15 (-23%)
Below Normal	-13 (-18%)	0 (0%)
Dry	-29 (-39%)	-6 (-11%)
Critical	-22 (-33%)	-2 (-4%)
All	-18 (-26%)	-5 (-9%)

[a] A negative value indicates a reduction in percentage of months outside suitable range H4_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 4A would not cause a substantial reduction in threadfin shad spawning habitat. Flows in all rivers examined during the April through August spawning period under Alternative 4A would generally be similar to or greater than flows under the NAA_ELT. Some flow reductions would occur late in the spawning season in the Feather River and would be too small in magnitude or frequency to have a biologically meaningful effect on threadfin shad. The percentage of years below the spawning temperature threshold would be similar or lower under Alternative 4A relative to the NAA_ELT, except in below normal years, but this increase is not expected to have a biologically meaningful effect on the threadfin shad population because it occurs in only one water year type and is isolated to the Feather River. Flow conditions in the Feather River under H4_ELT would be less favorable than those under H3_ELT, but would be similar to those under NAA_ELT.

CEQA Conclusion: In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions for threadfin shad relative to Existing Conditions.

H3_ELT/ESO_ELT

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during April through August spawning period. Lower flows could reduce the quantity and quality of instream habitat available for spawning.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during April through August, except in wet years during May (10% lower) and in dry and critical years during August (11% and 13% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). These are relatively small-magnitude and infrequent flow reductions and would not have biologically meaningful effects.

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during April through August, except in critical years during May and August (6% and 8% lower, respectively) and in wet years during July (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows under Existing Conditions during April through August (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under Existing Conditions during April through June, except in below normal years during April (6% lower) and in wet years during May (15% lower), and would be lower than flows under Existing Conditions in dry and critical years during July (22% and 52% lower, respectively) and in below normal and dry years during August (7% and 45% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to flows under Existing Conditions during April and lower than flows under Existing Conditions during May through August (up to 46% lower)respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly lower than those under Existing Conditions during April and May, and would be up to 23% lower than flows under Existing Conditions during June through August.

In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would be similar to or up to 14% lower than to those under Existing Conditions during April through August, except for 11% greater flow during June of wet years.

Water Temperature

The percentage of months below 68°F water temperature threshold for the April through August adult threadfin shad spawning period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures below this threshold could delay or prevent successful spawning in these areas. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. In the Feather River below Thermalito Afterbay, the percentage of months below the 68°F water temperature threshold for threadfin shad spawning under H3_ELT would be similar to or 12% to 34% lower than the percentage under Existing Conditions, depending on water year type (Table 11-4A-142).

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through August threadfin shad spawning period would generally be similar to flows under Existing Conditions except during May of wet years, when flow would be 11% lower(Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be up to 509% greater than flows under Existing Conditions during April through June, except for 38% and 6% lower flows during June of wet and critical water years, respectively, and would generally be up to 54% lower than flows under Existing Conditions during July and August, except for 26% higher flows in August of critical water years.

Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under Existing Conditions during April, and similar to or up to 37% lower than flows under Existing Conditions during May through August, except during August of below normal years (9% greater flow)

Flows in the Trinity River below Lewiston Reservoir and in Clear Creek at Whiskeytown Dam H4_ELT would generally be similar to flows under Existing Conditions during April through August, with minor exceptions.

Flows in the San Joaquin River at Vernalis under H4_ELT would generally be similar to or slightly lower than those under Existing Conditions during April and May, and would be up to 23% lower than flows under Existing Conditions during June through August.

Flows in the Stanislaus River at the confluence with the San Joaquin River under H4_ELT would generally be similar to or up to 14% lower than to those under Existing Conditions during April through August, except for 11% greater flow during June of wet years.

The percentage of months under H4_ELT with mean water temperatures below the 68°F temperature threshold in the Feather River below Thermalito Afterbay would be lower than the percentage under Existing Conditions in all water years (Table 11-4A-143). Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. Collectively, flows would be lower under Alternative 4A during the threadfin shad spawning period relative to Existing Conditions. Flows would be moderately to substantially lower in the Feather, American, Stanislaus, and San Joaquin rivers during substantial portions of the spawning period. Therefore, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce suitable spawning habitat as a result of flow reductions.

Summary of CEQA Conclusion

As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows and water temperatures in all rivers would generally be similar between NAA_ELT and Alternative 4A. These modeling results represent the increment of change attributable to the alternative, demonstrating the general similarities in flows and water temperature under Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Largemouth Bass

In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions for largemouth bass relative to the NAA_ELT.

H3_ELT/ESO_ELT

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the March through June largemouth bass spawning period. Lower flows could reduce the quantity and quality of instream spawning habitat.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT during March through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT during March through June, except in above normal years during April (17% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT during March through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would generally be moderately to substantially greater than flows under NAA_ELT during March through June, except in below normal years during March (13% lower) and in critical years during May and June (10% and 8% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows under NAA_ELT during March through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT during March through June, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would be similar to those under NAA_ELT during March through June, regardless of water year type.

Water Temperature

The percentage of months outside of the 59°F to 75°F suitable water temperature range for largemouth bass spawning during March through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT outside the 59°F to 75°F water temperature range would be similar to or lower than the percentage under NAA_ELT in all water year types (Table 11-4A-144).

Table 11-4A-144. Difference and Percent Difference in the Percentage of Months during March–June in Which Water Temperatures in the Feather River below Thermalito Afterbay Would Be outside the 59°F to 75°F Water Temperature Range for Largemouth Bass Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	-2 (-4%)	0 (0%)
Above Normal	-2 (-4%)	0 (0%)
Below Normal	0 (0%)	0 (0%)
Dry	-5 (-11%)	0 (0%)
Critical	-9 (-20%)	-3 (-8%)
All	-3 (-6%)	0 (0%)

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the March through June largemouth bass spawning period would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be similar to or up to 548% greater than flows under NAA_ELT during March through June, except in June of wet and critical water years, when the flow would be 12% and 10% lower, respectively, than flow under NAA_ELT.

Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under NAA_ELT during March through June, except for 10% higher flow during April of critical water years, 14% lower flow for May of critical years, and 10% lower flows for June of dry years.

Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under NAA_ELT during March through June, except for 17% lower flow during April of above normal water years.

Flows under H4_ELT in Clear Creek at Whiskeytown Dam would generally be similar to flows under NAA_ELT during March through June, except for 12% greater flow during March of below normal water years.

Flows under H4_ELT in the San Joaquin and Stanislaus Rivers would be similar to flows under NAA_ELT throughout the period.

The percentage of months under H4_ELT with mean water temperatures outside the 59°F to 75°F water temperature range in the Feather River below Thermalito Afterbay would be similar to or greater than the percentage under NAA_ELT in all water year types although these small increases on an absolute scale (≤5%) would not have biologically meaningful effects on largemouth bass spawning habitat conditions (Table 11-4A-145). Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H4_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. Water temperature modeling was not conducted in Clear Creek or the San Joaquin River.

Table 11-4A-145. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in the Percentage of Months during April–June in Which Water Temperatures in the Feather River below Thermalito Afterbay Would Be outside the 59°F to 75°F Water Temperature Range for Largemouth Bass Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	3 (5%)	5 (9%)
Above Normal	0 (0%)	2 (4%)
Below Normal	1 (2%)	1 (2%)
Dry	-5 (-11%)	0 (0%)
Critical	-6 (-14%)	0 (0%)
All	-1 (-2%)	2 (4%)

[a] A negative value indicates a reduction in percentage of months outside suitable range for H4_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 4A would not cause a substantial reduction in largemouth bass spawning habitat. Flows in all rivers examined during the March through June spawning period under Alternative 4A would generally be similar to or greater than flows under the NAA_ELT. There would be no substantial temperature effects under Alternative 4A in any river examined. Flow and water temperature conditions under H4_ELT would be less favorable than those under H3_ELT, but would be similar to those under NAA_ELT.

CEQA Conclusion: In general, Alternative 4A would not reduce the quality and quantity of upstream habitat conditions for largemouth bass relative to Existing Conditions.

H3_ELT/ESO_ELT

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the March through June largemouth bass spawning period. Lower flows could reduce the quantity and quality of instream spawning habitat.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during March through June, except in below normal years during March (8% lower) and in wet years during May (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during March through June, except in below normal years during March (6% lower) and in critical years during May (6% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows under Existing Conditions during March through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under Existing Conditions during March through June, except in below normal and dry years during March (39% and 17% lower, respectively), in below normal years during April (6% lower), and in wet years during May (15% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during March, April and June, except in critical years during March (8% lower), above normal years during April (5% lower), and in wet and critical years during June (21% and 29% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3_ELT would generally be lower than flows under Existing Conditions during May (to 16% lower) except in critical years (13% greater) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions in drier water year types, when effects on habitat conditions would be more critical, would be inconsistent and/or of small magnitude throughout the spawning period and would not have biologically meaningful negative effects.

In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly lower than those under Existing Conditions during March through June.

In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would generally be up to 23% lower than to those under Existing Conditions during March through June, except during these four months in wet years, in which flows under H3_ELT would range from 0.3% lower to 11% greater.

Water Temperature

The percentage of months outside of the 59°F to 75°F suitable water temperature range for largemouth bass spawning during March through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under Existing Conditions, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers.

In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT outside of the 59°F to 75°F water temperature range for largemouth bass spawning would be the same or lower than the percentage under Existing Conditions in all water year types (Table 11-4A-144).

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the March through June largemouth bass spawning period would generally be similar to or slightly lower than flows under Existing Conditions, except during May of wet years when flows would be 11% lower under H4_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be similar or up to 509% greater than flows under Existing Conditions during March through June, except during March of below normal and dry water years, when flows under H4_ELT would be 22% and 11% lower, respectively, and during June of wet and critical water years, when flow under H4_ELT would be 37% lower and 6% lower, respectively.

Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under Existing Conditions during March and April, and generally up to 27% lower than flows under Existing Conditions during May and June.

Flows under H4_ELT in the Trinity River at Lewiston would generally be similar to those under Existing Conditions during March through June, except during March of wet years, in which flow under H4_ELT would be 14% greater than flow under Existing Conditions.

Flows under H4_ELT in Clear Creek at Whiskeytown Dam would generally be similar to those under Existing Conditions during March through June, except during March of below normal and critical water years, in which flow under H4_ELT would be 13% and 10% greater, respectively, than flow under Existing Conditions.

Flows under H4_ELT in the San Joaquin River at Vernalis would generally be similar to or slightly lower than those under Existing Conditions during March through June, except during March of below normal and dry water years, when flow under H4_ELT would be 11% and 12% lower, respectively, and during June of wet and dry water years, when flows would be 16% and 12% lower, respectively.

Flows under H4_ELT in the Stanislaus River at the confluence with the San Joaquin River would generally be up to 23% lower than to those under Existing Conditions during March through June, except during wet years, in which flow under H4_ELT would range from 0.3% lower to 11% greater than flow under Existing Conditions.

The percentage of months under H4_ELT with mean water temperatures below outside the 59°F to 75°F water temperature range in the Feather River below Thermalito Afterbay would be similar to the percentage under Existing Conditions in wet, above normal, and below normal water year types and would be lower than the percentage under Existing Conditions in dry and critical water year types (Table 11-4A-143). The reductions would not be large enough to have biologically meaningful effects on largemouth bass spawning habitat conditions. Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H4_ELT would generally be the same as those under Existing Conditions, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers.

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the impact would not be significant because Alternative 4A would not cause a substantial reduction in largemouth bass spawning habitat relative to Existing Conditions, and no mitigation is necessary. Flows in all rivers examined except the San Joaquin and Stanislaus Rivers during the March through June spawning period under Alternative 4A would generally be similar to or greater than flows under Existing Conditions. There would be isolated and/or small-magnitude flow reductions for some months and water year types in the San Joaquin and Stanislaus Rivers that would not have biologically meaningful negative effects to largemouth bass. There would be no substantial temperature effects under Alternative 4A on largemouth bass. Flow and water temperature conditions under H4_ELT would be less favorable than those under H3_ELT, but would be similar to those under Existing Conditions.

Sacramento Tule Perch

NEPA Effects: The effects of water operations on spawning habitat for Sacramento tule perch under Alternative 4A would be similar to that described for Alternative 1A due to similarities in hydrology. For a detailed discussion, please see Alternative 1A, Impact AQUA-202. The effects would not be adverse.

CEQA Conclusion: As described under Alternative 1A, Impact AQUA-202 the impacts on Sacramento tule perch spawning would be not be significant and no mitigation is required.

Sacramento-San Joaquin Roach – California species of special concern

In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions for Sacramento-San Joaquin roach relative to the NAA_ELT.

H3_ELT/ESO_ELT

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the March through June Sacramento-San Joaquin roach spawning period. Lower flows could reduce the quantity and quality of instream habitat available for spawning.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT during March through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT during March through June, except in above normal years during April (17% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT during March through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would generally be moderately to substantially greater than flows under NAA_ELT during March through June, except in below normal years during March (13% lower) and in critical years during May and June (10% and 8% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows under NAA_ELT during March through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT during March through June, regardless of water year type (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Stanislaus River at the confluence with the San Joaquin River flows under H3_ELT would be similar to those under NAA_ELT during March through June, regardless of water year type (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Water Temperature

The percentage of months below the 60.8°F water temperature threshold for Sacramento-San Joaquin roach spawning initiation during March through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures below this threshold could delay or prevent spawning initiation. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. In the Feather River below Thermalito Afterbay, the percentage of months in which temperatures would be below the 60.8°F water temperature threshold for roach spawning initiation under H3_ELT would be similar to or lower than the percentage under NAA_ELT in all water year types (Table 11-4A-146).

Table 11-4A-146. Difference and Percent Difference in the Percentage of Months during March–June in Which Water Temperatures in the Feather River below Thermalito Afterbay Fall below the 60.8°F Water Temperature Threshold for the Initiation of Sacramento-San Joaquin Roach Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	-8 (-11%)	0 (0%)
Above Normal	-5 (-8%)	0 (0%)
Below Normal	-2 (-4%)	0 (0%)
Dry	-8 (-15%)	-3 (-6%)
Critical	-6 (-11%)	2 (4%)
All	-6 (-11%)	0 (-1%)

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

H4_ELT /HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the March through June Sacramento-San Joaquin roach spawning period would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be similar to or up to 548% greater than flows under NAA_ELT during March through June, except in June of wet and critical water years, when the flow would be 12% and 10% lower, respectively, than flow under NAA_ELT.

Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under NAA_ELT during March through June, except for 10% higher flow during April of critical water years, 14% lower flow for May of critical years, and 10% lower flows for June of dry years.

Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under NAA_ELT during March through June, except for 17% lower flow during April of above normal water years.

Flows under H4_ELT in Clear Creek at Whiskeytown Dam would generally be similar to flows under NAA_ELT during March through June, except for 12% greater flow during March of below normal water years.

Flows under H4_ELT in the San Joaquin and Stanislaus Rivers would be similar to flows under NAA_ELT throughout the period. The percentage of months under H4_ELT with mean water temperatures below the 60.8°F water temperature range in the Feather River below Thermalito Afterbay would be similar to or up to 18% greater than the percentage under NAA_ELT, although these small increases on an absolute scale (≤9%) would not have biologically meaningful effects on roach spawning habitat conditions. (Table 11-4A-147). Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H4_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. Water temperature modeling was not conducted in Clear Creek or the San Joaquin River.

Table 11-4A-147. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in the Percentage of Months during March–June in Which Water Temperatures in the Feather River below Thermalito Afterbay Would Fall below the 60.8°F Water Temperature Threshold for Sacramento-San Joaquin Roach Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	-4 (-6%)	4 (6%)
Above Normal	5 (8%)	9 (18%)
Below Normal	4 (7%)	5 (11%)
Dry	-4 (-8%)	1 (3%)
Critical	-11 (-19%)	-2 (-4%)
All	-3 (-4%)	3 (6%)

[a] A negative value indicates a reduction in percentage of months outside suitable range for H4_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 4A would not cause a substantial reduction in roach spawning habitat. Flows in all rivers examined during the March through June spawning period under Alternative 4A would generally be similar to or greater than flows under the NAA_ELT. The occurrence of flow reductions would not be of sufficient magnitude or frequency to have a biologically meaningful effect on roach. There would be no substantial temperature effects under Alternative 4A in any river examined. Flow and water temperature conditions under H4_ELT would be less favorable than those under H3_ELT, but would be similar to those under NAA_ELT.

CEQA Conclusion: In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions for Sacramento-San Joaquin Roach relative to Existing Conditions.

H3_ELT/ESO_ELT

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the March through June Sacramento-San Joaquin roach spawning period. Lower flows could reduce the quantity and quality of instream habitat available for spawning.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during March through June, except in below normal years during March (8% lower) and in wet years during May (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during March through June, except in below normal years during March (6% lower) and in critical years during May (6% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows under Existing Conditions during March through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under Existing Conditions during March through June, except in below normal and dry years during March (39% and 17% lower, respectively), in below normal years during April (6% lower), and in wet years during May (15% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during March, April and June, except in critical years during March (8% lower), above normal years during April (75% lower), and in wet and critical years during June (21% and 29% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3_ELT would generally be lower than flows under Existing Conditions during May (to 16% lower), except in critical years (13% greater) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions in drier water year types, when effects on habitat conditions would be more critical, would be inconsistent and/or of small magnitude throughout the spawning period and would not have biologically meaningful negative effects.

In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly lower than those under Existing Conditions during March through June, except during March of below normal and dry water years, when flow under H3_ELT would be 11% and 12% lower, respectively, and during June of wet and dry water years, when flows would be 16% and 11% lower, respectively.

In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly lower than those under Existing Conditions during March through June.

In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would generally be up to 23% lower than to those under Existing Conditions during March through June, except during these four months in wet years, in which flows under H3_ELT would range from 0.3% lower to 11% greater.

Water Temperature

The percentage of months below the 60.8°F water temperature threshold for Sacramento-San Joaquin roach spawning initiation during March through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures below this threshold could delay or prevent spawning initiation. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under Existing Conditions, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers.

In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT in which temperatures would be below the 60.8°F water temperature threshold for roach spawning initiation would be lower than the percentage under Existing Conditions in all water year types (Table 11-4A-146).

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the March through June Sacramento-San Joaquin roach spawning period would generally be similar to or slightly lower than flows under Existing Conditions, except during May of wet years when flows would be 11% lower under H4_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be similar or up to 509% greater than flows under Existing Conditions during March through June, except during March of below normal and dry water years, when flows under H4_ELT would be 22% and 11% lower, respectively, and during June of wet and critical water years, when flow under H4_ELT would be 37% lower and 6% lower, respectively.

Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under Existing Conditions during March and April, and generally up to 27% lower than flows under Existing Conditions during May and June.

Flows under H4_ELT in the Trinity River at Lewiston would generally be similar to those under Existing Conditions during March through June, except during March of wet years, in which flow under H4_ELT would be 14% greater than flow under Existing Conditions.

Flows under H4_ELT in Clear Creek at Whiskeytown Dam would generally be similar to those under Existing Conditions during March through June, except during March of below normal and critical water years, in which flow under H4_ELT would be 13% and 10% greater, respectively, than flow under Existing Conditions.

Flows under H4_ELT in the San Joaquin River at Vernalis would generally be similar to or slightly lower than those under Existing Conditions during March through June, except during March of below normal and dry water years, when flow under H4_ELT would be 11% and 12% lower, respectively, and during June of wet and dry water years, when flows would be 16% and 12% lower, respectively.

Flows under H4_ELT in the Stanislaus River at the confluence with the San Joaquin River would generally be up to 23% lower than to those under Existing Conditions during March through June, except during wet years, in which flow under H4_ELT would range from 0.3% lower to 11% greater than flow under Existing Conditions.

The percentage of months under H4_ELT with mean water temperatures below the 60.8°F water temperature range in the Feather River below Thermalito Afterbay would be up to 7% and 8% higher than the percentage under Existing Conditions in above normal and below normal water years, respectively, and would be up to 19% lower than the percentage under Existing Conditions in the other three water year types (Table 11-4A-147). Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H4_ELT would generally be the same as those under Existing Conditions, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers.

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the impact would not be significant because Alternative 4A would not cause a substantial reduction in Sacramento-San Joaquin roach spawning habitat relative to Existing Conditions, and no mitigation is necessary. Flows in all rivers examined except the San Joaquin and Stanislaus Rivers during the March through June spawning period under Alternative 4A would generally be similar to or greater than flows under Existing Conditions. There would be isolated and/or small-magnitude flow reductions for some months and water year types in the San Joaquin and Stanislaus Rivers that would not have biologically meaningful negative effects to Sacramento-San Joaquin roach. There would be no substantial temperature effects under Alternative 4A on Sacramento-San Joaquin roach. Flow and water temperature conditions under H4_ELT would be less favorable than those under H3_ELT, but would be similar to those under Existing Conditions.

Hardhead – California species of special concern

In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions for hardhead relative to the NAA_ELT.

H3_ELT/ESO_ELT

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through May hardhead spawning period. Lower flows could reduce the quantity and quality of instream habitat available for spawning.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT during April and May) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to flows under NAA_ELT during April and May, except in above normal years during April (17% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT during April and May (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would generally be similar to moderately greater than flows under NAA_ELT during April and May, except in critical years in May (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows under NAA_ELT during April and May (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT during April and May, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River flows under H3_ELT would be similar to those under NAA_ELT during April and May, regardless of water year type.

Water Temperature

The percentage of years outside of the 59°F to 64°F suitable water temperature range for hardhead spawning during April through May was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success and increased egg and larval stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature-related effects in these rivers. In the Feather River below Thermalito Afterbay, the percentage of years under H3_ELT outside the 59°F to 64°F suitable water temperature range would be similar to or lower than the percentage under NAA_ELT in all water year types (Table 11-4A-148).

Table 11-4A-148. Difference and Percent Difference in the Percentage of Months during April–May in Which Water Temperatures in the Feather River below Thermalito Afterbay Would Be outside the 59°F to 64°F Water Temperature Range for Hardhead Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	1 (2%)	0 (0%)
Above Normal	4 (6%)	-5 (-7%)
Below Normal	18 (42%)	4 (7%)
Dry	5 (9%)	-6 (-9%)
Critical	-8 (-15%)	-8 (-15%)
All	4 (7%)	-3 (-5%)

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

H4_ELT /HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through May period would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Flows under H4_ELT in the Feather River at Thermalito Afterbay would be similar to or up to 548% greater than flows under NAA_ELT during April and May.

Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under NAA_ELT during April and May, except for 10% higher flow during April of critical water years and 14% lower flow for May of critical years.

Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under NAA_ELT during April and May, except for 17% lower flow during April of above normal water years.

Flows under H4_ELT in the San Joaquin and Stanislaus Rivers and in Clear Creek would be similar to flows under NAA_ELT in both April and May.

The percentage of months under H4_ELT with mean water temperatures outside the 59°F to 64°F suitable water temperature range in the Feather River below Thermalito Afterbay would be similar to or up to 19% lower than the percentage under NAA_ELT in all water years, except wet years (10% greater) (Table 11-4A-149). Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H4_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. Water temperature modeling was not conducted in Clear Creek or the San Joaquin River.

Table 11-4A-149. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in the Percentage of Months during April–May in Which Water Temperatures in the Feather River below Thermalito Afterbay Would Fall outside the 59°F to 64°F Water Temperature Range for Hardhead Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	7 (11%)	6 (10%)
Above Normal	-5 (-8%)	-14 (-19%)
Below Normal	14 (33%)	0 (0%)
Dry	5 (9%)	-6 (-9%)
Critical	-4 (-7%)	-4 (-7%)
All	5 (9%)	-2 (-3%)

[a] A negative value indicates a reduction in percentage of months outside suitable range for H4_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 4A would not cause a substantial reduction in hardhead spawning habitat. Flows in all rivers examined during the April through May spawning period under Alternative 4A would generally be similar to or greater than flows under the NAA_ELT. There would be no substantial temperature effects under Alternative 4A in any river examined. Flow and water temperature conditions under H4_ELT would be less favorable than those under H3_ELT, but would be similar to those under NAA_ELT.

CEQA Conclusion: In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions for hardhead relative to Existing Conditions.

H3_ELT/ESO_ELT

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through May hardhead spawning period. Lower flows could reduce the quantity and quality of instream habitat available for spawning.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to flows under Existing Conditions during April through May, except in wet years during May (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during April through May, except in critical years during May (6% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under Existing Conditions during April through May, except in critical years during May (6% lower)(Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under Existing Conditions during April through May, except in below normal years during April (6% lower) and in wet years during May (15% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during April, except in above normal years (5% lower), but generally lower than flows under Existing Conditions during May, except in critical years (13% greater) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). These few flow reductions are relatively small in magnitude and, therefore would not have biologically meaningful negative effects.

In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly lower than those under Existing Conditions during April and May.

In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would generally be similar to or up to 12% lower than to those under Existing Conditions during April and May.

Water Temperature

The percentage of months outside of the 59°F to 64°F suitable water temperature range for hardhead spawning during April through May was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success and increased egg and larval stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under Existing Conditions, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT outside of the 59°F to 64°F water temperature range for hardhead spawning would be greater than the percentage under Existing Conditions in all water years types, except critical years (15% lower) (Table 11-4A-148).

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through May period would generally be similar to or up to 11% lower (May of wet years) than flows under Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be up to 509% greater than flows under Existing Conditions during April and May.

Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under Existing Conditions during April, and up to 18% lower than flows under Existing Conditions during May.

Flows under H4_ELT in the San Joaquin River at Vernalis would generally be similar to or slightly lower than those under Existing Conditions during April and May.

Flows under H4_ELT in the Stanislaus River at the confluence with the San Joaquin River would generally be similar to or up to 13% lower than to those under Existing Conditions during April and May.

Flows under H4_ELT in the Trinity River and Clear Creek would be similar to flows under Existing Conditions in both months, except for 10% higher flows in Clear Creek during April of critical water years.

The percentage of months under H4_ELT with mean water temperatures outside the 59°F to 64°F suitable water temperature range in the Feather River below Thermalito Afterbay would be slightly lower than the percentage under Existing Conditions in above normal and critical water years and would be up to 33% higher than the percentage under Existing Conditions in wet, below normal and dry water years (Table 11-4A-149). Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H4_ELT would generally be the same as those under Existing Conditions, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers.

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the effect would be less than significant because Alternative 4A would not cause a substantial reduction in roach spawning habitat, and no mitigation is necessary. Flows in most rivers examined during the April through May spawning period under Alternative 4A would generally be similar to or greater than flows under Existing Conditions. Flows in the San Joaquin and Stanislaus Rivers would be lower under Alternative 4A, although these reductions would not have population-level effects on hardhead. There would be no substantial temperature effects under Alternative 4A on roach. Therefore, the impact would be less than significant and no mitigation is required.

California Bay Shrimp

NEPA Effects: The effect of water operations on spawning habitat of California bay shrimp under Alternative 4A would be similar to that described for Alternative 1A (see Alternative 1A, Impact AQUA-202) due to similarities in hydrology. For a detailed discussion, please see Alternative 1A, Impact AQUA-202. The effects would not be adverse.

CEQA Conclusion: The impact of water operations on spawning habitat of California bay shrimp would be the same as described immediately above. The impact would be less than significant and no mitigation would be required.

Impact AQUA-203: Effects of Water Operations on Rearing Habitat for Non-Covered Aquatic Species of Primary Management Concern

See Alternative 1A, Impact AQUA-203 for additional background information relevant to non-covered species of primary management concern. The analysis for striped bass, American shad, and bay shrimp includes new analysis across all alternatives that is described in detail in Chapter 11, Section 11.3.5, in Appendix A. The analysis below for Alternative 4A draws on that analysis.

Striped Bass

NEPA Effects: The discussion under Alternative 4A, Impact AQUA-202 for striped bass also addressed the embryo incubation and initial rearing period. That analysis indicates that there is no adverse effect on striped bass rearing during that period. As discussed further in Chapter 11, Section 11.3.5, in Appendix A, water operations have the potential to affect striped bass juvenile abundance through changes in the extent of rearing habitat in the Plan Area as indexed by X2 (Kimmerer et al. 2009). Several X2-abundance index or X2-survival index relationships from Kimmerer et al. (2009) were applied to striped bass in order to assess the potential effects on abundance or survival through changes in rearing habitat. Application of these relationships suggested that, in relation to NAA_ELT, there generally would be only a small change in mean abundance index (<5%) as a result of change in rearing habitat under Alternative 4A scenarios H3_ELT and H4_ ELT (See Table 11-mult-6, Table 11-mult-7, Table 11-mult-8, Table 11-mult-9, and Table 11-mult-10 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS). The exceptions were the mean bay midwater trawl abundance index (7% reduction; Table 11-mult-9) and the mean summer townet survival index (6% reduction; Table 11-mult-6). These results indicate that the operational effects would not be adverse, because they would not result in a substantial reduction in the rearing habitat for striped bass.

CEQA Conclusion: The analysis of potential water operations-related rearing habitat effects illustrated that in relation to Existing Conditions (see Table 11-mult-6, Table 11-mult-7, Table 11-mult-8, Table 11-mult-9, and Table 11-mult-10 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS), there could be significant impacts of the Alternative 4A on survival or abundance of striped bass, in contrast to the conclusion presented above in the NEPA Effects section. As described in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both Alternative 4A and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur in the ELT, including the projected effects of climate change (precipitation patterns), sea level rise and future water demands. Because Alternative 4A modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands. In the case of the X2-related analyses of rearing habitat for striped bass, the effect of sea level rise in particular confounds the interpretation of the effects of the alternatives. When compared to NAA_ELT and informed by the NEPA analysis above, the change in rearing habitat would be less than significant. No mitigation would be necessary.

American Shad

NEPA Effects: As discussed further in Chapter 11, Section 11.3.5, in Appendix A, water operations have the potential to affect American shad juvenile abundance through changes in the extent of rearing habitat in the Plan Area as indexed by X2 (Kimmerer et al. 2009). Two X2-abundance index relationships from Kimmerer et al. (2009) were applied to American shad in order to assess the potential effects on abundance through changes in rearing habitat. Application of these relationships suggested that, in relation to NAA_ELT, there would be only a small change in mean abundance index (<5%) as a result of change in rearing habitat under Alternative 4A scenarios H3_ELT and H4_ELT(See Table 11-mult-11, Table 11-mult-12 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS). These modeling results indicate that the operational effects would not be adverse, because they would not result in a substantial reduction in the rearing habitat for American shad.

CEQA Conclusion: Similar to striped bass, the analysis of potential water operations-related rearing habitat effects illustrated that in relation to Existing Conditions, there could be a greater impact of Alternative 4A on abundance of American shad (Table 11-mult-11, Table 11-mult-12 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS), than found in the NEPA Effects section. As noted for striped bass, the comparison to the NAA_ELT is a better approach than comparison to Existing Conditions because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands. In the case of the X2-related analyses of rearing habitat for American shad, the effect of sea level rise in particular confounds the interpretation of the effects of the alternatives. Based on the discussion presented above for the NEPA Effects, the change in rearing habitat would be less than significant. No mitigation would necessary.

Threadfin Shad

NEPA Effects: The effects of water operations on rearing habitat for threadfin shad under Alternative 4A would be similar to that described for Alternative 1A (see Alternative 1A, Impact AQUA-203) due to similarities in hydrology. For a detailed discussion, please see Alternative 1A, Impact AQUA-203. The effects would not be adverse.

CEQA Conclusion: As described above the impacts on threadfin shad rearing habitat would be less than significant and no mitigation would be required.

Largemouth Bass

H3_ELT/ESO_ELT

Juveniles

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through November juvenile largemouth bass rearing period. Lower flows could reduce the quantity and quality of instream habitat available for juvenile rearing.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT during April through October with some exceptions (to 14% lower), and would be lower in all water year types during November (to 18% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions in drier water years, when effects on habitat conditions would be more critical, would be inconsistent and/or of small magnitude for all months during the rearing period and would not have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to flows under NAA_ELT with isolated exceptions, including flow reduction in above normal years during April (to 17% lower) and small flow reductions in above normal years during October (7% lower) and in wet years during November (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT during April through November, except in critical years during August (11% greater) and in critical years during July, September, and October (to 14% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would generally be moderately to substantially greater than flows under NAA during April through June (to 106% greater), except in critical years during May and June (to 10% lower); moderately to substantially lower than flows under NAA during July through September (to 48% lower), except in critical years during August and September (to 25% greater); and similar to or greater than flows under NAA_ELT during October and November (to 19% greater) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions during July through September would be partially offset by increases in flow in the adjoining months.

In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows under NAA during April through July and October, except in wet years during October (6% lower), and would be similar to or lower than flows under NAA_ELT during August, September, and November (to 22% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions would be offset by increases in some months and/or not persistent within a single water year type. Effects would not be biologically meaningful.

In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT during April through November, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River flows under H3_ELT would be similar to those under NAA_ELT during April through November, regardless of water year type.

Water Temperature

The percentage of months above the 88°F water temperature threshold for juvenile largemouth bass rearing during April through November was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Elevated water temperatures could lead to reduced quantity and quality of instream habitat available for juvenile rearing and increased stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT. Therefore, there would be no temperature related effects of H3_ELT in these rivers during the April through November period.

In the Feather River below Thermalito Afterbay, water temperatures would not exceed 88°F under NAA_ELT or H3_ELT. As a result, there would be no difference between NAA_ELT and H3_ELT in the percentage of months in which the 88°F water temperature threshold is exceeded (Table 11-4A-150).

Table 11-4A-150. Difference and Percent Difference in the Percentage of Months during April–November in Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed the 88°F Water Temperature Threshold for Juvenile Largemouth Bass Rearing[a]

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

Adults

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during year-round adult largemouth bass residency period. Lower flows could reduce the quantity and quality of instream habitat available for adults.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT throughout the year with some exceptions (up to 14% lower), and would be lower in all water year types during November (up to 18% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions in drier water years, when effects on habitat conditions would be more critical, would be inconsistent and/or of small magnitude for all months during the rearing period and, therefore, would not have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT during the period, except in above normal years in April and October (17% and 8% lower, respectively), and in wet years during November (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT throughout the year, except in critical years during July (14% lower), August (11% greater), September (10% lower), and October (7% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would generally be lower than flows under NAA_ELT during January and July through September, except in critical years in August and September (23% and 25% greater, respectively); would generally be similar to or greater than flows under NAA during February through June, except for below normal years during February and March (11% and 13% lower, respectively) and in critical years during May and June (10% and 8% lower, respectively); and would generally be similar to or greater than flows under NAA_ELT during November and December, except in wet years during December (5% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows would be more persistently lower under H3_ELT relative to NAA_ELT (up to 48% lower) during July, August, and in all water year types except critical years during September. Flow reductions would be partially offset by increases in flow in the adjoining months.

In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows under NAA_ELT during January through July and December, except in below normal years during January (11% lower), and would be similar to or lower than flows under NAA_ELT (up to 22% lower) during August through November, except in below normal and critical years during October (16% and 22% greater, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions would be offset by increases in some months and/or not persistent within a single water year type. Effects would not be biologically meaningful.

In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River flows under H3_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

The analysis for Alternative 1A indicates that there would be no differences in flows between H3 and NAA_ELT.

Water Temperature

The percentage of months above the 86°F water temperature threshold for year-round adult largemouth bass residency period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Elevated water temperatures could lead to reduced quantity and quality of habitat and increased stress and mortality for adults. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT. Therefore, there would be no temperature related effects of H3_ELT in these rivers during any month.

In the Feather River below Thermalito Afterbay, water temperatures would not exceed 86°F under NAA_ELT and H3_ELT (Table 11-4A-151). As a result, there would be no difference in the percentage of months in which the 86°F water temperature threshold is exceeded between NAA_ELT and H3_ELT.

Table 11-4A-151. Difference and Percent Difference in the Percentage of Months Year-Round in Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed the 86°F Water Temperature Threshold for Adult Largemouth Bass Survival[a]

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

H4_ELT /HOS_ELT

Juveniles

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through November juvenile largemouth bass rearing period would generally be similar to flows under NAA_ELT, except during November of all water year types, when flows would be up to 15% lower (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be up to 548% greater than flows under NAA_ELT during April through June, except for 12% and 10% lower flows during June of wet and critical water years, respectively, and would generally be similar to or up to 60% lower than flows under NAA_ELT during July through November, except in August through November of critical water years, when flows under NAA_ELT would range from 11% to 52% higher. Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under NAA_ELT during April through November, except for 14% lower flow in May of critical water years, 28% lower flow in August of critical years, 20% lower flows in September of below normal years, 18% greater flow in August of below normal years, and 15% and 21% greater flows in October of below normal and critical water years, respectively. Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under NAA_ELT, during April through November, except for 17% lower flow during April of above normal water years, 16% greater flow in September of critical years, and 11% greater flow during October of above normal water years. Flows under H4_ELT in Clear Creek below Whiskeytown would generally be similar to flows under NAA_ELT during April through November, except for 14% lower flow and 11% higher flow during July and August, respectively, of critical water years. Flows under H4_ELT in the San Joaquin and Stanislaus Rivers would be similar to flows under NAA_ELT throughout the period.

Water temperatures in the Feather River below Thermalito Afterbay during the April through November juvenile largemouth bass rearing period would not exceed the 88°F water temperature threshold in H4_ELT or NAA_ELT. As a result, there would be no difference between H4_ELT and NAA_ELT in the percentage of months in which the 88°F water temperature threshold is exceeded (Table 11-4A-152).

Table 11-4A-152. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in the Percentage of Months during April–November in Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed the 88°F Water Temperature Threshold for Juvenile Largemouth Bass Rearing[a]

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

[a] A negative value indicates a reduction in percentage of months outside suitable range for H4_ELT.

Adults

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the year-round adult largemouth bass residency period would generally be similar to flows under NAA_ELT, except for 10% lower flow during September of below normal water years and except during November of all water year types, when flows would be up to 15% lower (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be up to 548% greater than flows under NAA_ELT during April through June, except for 12% and 10% lower flows during June of wet and critical water years, respectively. The Feather River flows under H4_ELT would generally be similar to or up to 60% lower than flows under NAA_ELT during July through November, except in August through November of critical water years, when flows under NAA_ELT would range from 11% to 52% higher, and the flows would generally be similar to or up to 40% higher under NAA_ELT during December through March. Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under NAA_ELT throughout the year, except for 14% lower flow in May of critical water years, 28% lower flow in August of critical years, 20% lower flows in September of below normal years, 18% greater flow in August of below normal years, and 15% and 21% greater flows in October of below normal and critical water years, respectively. Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under NAA_ELT throughout the year, except for 10% higher flow during February of wet years, 17% lower flow during April of above normal water years, 16% greater flow during September of critical years, and 11% greater flow during October of above normal water years. Flows under H4_ELT in Clear Creek below Whiskeytown would generally be similar to flows under NAA_ELT throughout the year, except for 12% higher flow in March of below normal water years, and 14% lower flow and 11% higher flow during July and August, respectively, of critical water years. Flows under H4_ELT in the San Joaquin and Stanislaus Rivers would be similar to flows under NAA_ELT throughout the year.

Water temperatures in the Feather River below Thermalito Afterbay during the year-round adult largemouth bass residency period would not exceed the 86°F water temperature threshold in H4_ELT or NAA_ELT. As a result, there would be no difference between H4_ELT and NAA_ELT in the percentage of months in which the 86°F water temperature threshold is exceeded (Table 11-4A-153).

Table 11-4A-153. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in the Percentage of Months Year-Round in Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed the 86°F Water Temperature Threshold for Adult Largemouth Bass Survival[a]

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

[a] A negative value indicates a reduction in percentage of months outside suitable range for H4_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 4A would not cause a substantial reduction in juvenile rearing and adult spawning habitat. Flows in all rivers examined during the year under Alternative 4A are generally similar to or greater than flows under the NAA_ELT in most months. Flows in July or August through November are more likely to be lower for some water year types in some of the locations analyzed, however they are generally of small magnitude, not consistent from month to month within a specific water year type, and/or would be offset by increases in flow in the adjoining months. Therefore, the flow reductions are not expected to have biologically meaningful negative effects on the largemouth bass population. Flow-related habitat conditions for both juvenile and adult largemouth bass under H4_ELT would be less favorable than those under H3_ELT although not different from NAA_ELT. There are no temperature-related effects in any other rivers examined.

CEQA Conclusion: In general, Alternative 4 would not reduce the quality and quantity of upstream habitat conditions for largemouth bass relative to Existing Conditions.

H3_ELT/ESO_ELT

Juveniles

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through November juvenile largemouth bass rearing period. Lower flows could reduce the quantity and quality of instream habitat available for juvenile rearing.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during April through July, except in wet years during

May (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows would generally be similar to or lower than flows under Existing Conditions during August through November (to 22% lower), except in above normal and below normal years during August (to 7% greater) and in wet and above normal years during September (to 32% greater) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). There would be primarily small flow reductions in some drier water year types for some months, but not persistent enough and of a magnitude that would not be expected to have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during April through July, except in critical years during May (6% lower) and in wet years during July (10% lower), and similar to or lower than flows under Existing Conditions during August through November (to 17% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). The persistent, small to moderate flow reductions years during August through November would have a localized effect on rearing conditions.

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows under Existing Conditions during April through November, except in critical years during September (19% lower) and in below normal years during October (6% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). This flow reduction is a relatively small, isolated effect limited to a single water year type and would not be expected to have biologically meaningful negative effects.

In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under Existing Conditions during April through June, September, and October, with a few isolated exceptions (to 50% lower)(Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3_ELT would generally be moderately to substantially lower than flows under Existing Conditions during July, August, and November (to 52% lower), except in wet and above normal years during July and August (to 50% greater) and in above normal years during November (5% greater).

In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during April, except in above normal years (5% lower), but generally lower, by up to 46%, during May through November (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). There would be moderate flow reductions in drier water year types, when effects would be most critical for habitat conditions, for some months/water year types from May through November that would affect rearing conditions at this location.

In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly lower than those under Existing Conditions during April and May and September through November, and would be similar to or up to 23% lower than flows under Existing Conditions during June through August.

In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would generally be similar to or up to 14% lower than to those under Existing Conditions during April through July, except for 11% greater flow during June of wet years, and would be similar to or slightly lower than flows under Existing Conditions during August through November.

Water Temperature

The percentage of months above the 88°F water temperature threshold for juvenile largemouth bass rearing during April through November was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Elevated water temperatures could lead to reduced quantity and quality of instream habitat available for juvenile rearing and increased stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under Existing Conditions. Therefore, there would be no temperature related effects of H3_ELT in these rivers during the April through November period.

In the Feather River below Thermalito Afterbay, water temperatures would not exceed the 88°F water temperature threshold for juvenile largemouth bass during the April through November rearing period under Existing Conditions or H3_ELT (Table 11-4A-150). As a result, there would be no difference in the percentage of months in which the 88°F water temperature threshold is exceeded between H3_ELT and Existing Conditions.

Adults

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the year-round adult largemouth bass residency period. Lower flows could reduce the quantity and quality of instream habitat available for adults.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during January through April and December, except in drier years during January (to 13% lower), in dry and critical years during February (8% and 6% lower, respectively), in critical years during March (8% lower), in above normal years in April (5% lower), and in dry and critical years during December (8% and 5% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows would generally be similar to or lower than flows under Existing Conditions during May through November (to 46% lower), except in critical years during May (13% greater), in below normal and dry years during June (8% and 25% greater, respectively), and in below normal and critical years during October (10% and 15% greater, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). There would be primarily small flow reductions in some water year types for some months, but not persistent enough and of a magnitude that would not be expected to have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during January through June and December, except in below normal years during January (16% lower), in below normal years during March (6% lower), and in critical years during May (6% lower), but would generally be similar to or lower than flows under Existing Conditions during July through November, except in below normal years during July (5% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). The persistent, small to moderate flow reductions in critical years would have a localized effect on conditions for adults in that water year type.

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows under Existing Conditions throughout the year, except in critical years during September and in below normal years during October (19% and 6% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). This flow reduction is a relatively isolated effect limited to a single water year type in each month and would not be expected to have biologically meaningful negative effects.

In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under Existing Conditions during February through June, September, and October, except in drier years during February (to 48% lower), in below normal and dry years during March (39% and 17% lower, respectively), in below normal years during April (6% lower), in wet years during May (15% lower), in below normal and critical years during September (26% and 50% lower, respectively), and in wet and critical years during October (6% and 7% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3_ELT would generally be moderately to substantially lower than flows under Existing Conditions in January, July, August, November, and December, except in wet and above normal years during July (15% and 9% greater, respectively), in below normal and dry years during August (7% and 45% greater, respectively), in above normal years during November (5% greater), and in above normal years during December (18% greater).

In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions in wetter years during January, in wet and below normal years during December, and in most water year types during February through April, except in dry and critical years during February (8% and 6% lower, respectively), in critical years during March (7% lower), and in above normal years during April (5% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3_ELT would generally be similar to or lower than flows under Existing Conditions during May through November, except in critical years during May (13% greater), in below normal and dry years during June (8% and 25% greater, respectively), and in below normal and critical years during October (10% and 15% greater, respectively). There would be persistent small to substantial flow reductions that would affect conditions for adults at this location.

In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly lower than those under Existing Conditions during April, May and September through November, would be similar to or up to 23% lower than flows under Existing Conditions during February, March, and June through August, and would be similar to or up to 11% greater than flows under Existing Conditions during December and January.

In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would generally be similar to or up to 29% lower than to those under Existing Conditions during January through July, except for 17% and 11% greater flow in wet years during February and June, respectively, and would be similar to or slightly lower than flows under Existing Conditions during August through December.

Water Temperature

The percentage of months above the 86°F water temperature threshold for year-round adult largemouth bass residency period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Elevated water temperatures could lead to reduced quantity and quality of habitat for adults and increased stress and mortality of adults. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under Existing Conditions. Therefore, there would be no temperature related effects of H3_ELT in these rivers during any month.

In the Feather River below Thermalito Afterbay, water temperatures would not exceed the 86°F water temperature threshold for adult largemouth bass under Existing Conditions or H3_ELT (Table

11-4A-151). As a result, there would be no difference in the percentage of months in which the 86°F water temperature threshold is exceeded between H3_ELT and Existing Conditions.

H4_ELT/HOS_ELT

Juveniles

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through July juvenile largemouth bass rearing period would generally be similar to flows under Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under in the Feather River at Thermalito Afterbay would be greater (up to 509%) than those under Existing Conditions June, with few exceptions. Flows under H4_ELT in the American River at Nimbus Dam would generally be similar to flows under Existing Conditions during April, but up to 27% lower than flows under Existing Conditions during May and June. Flows under H4_ELT in the Trinity River would generally be similar to flows under Existing Conditions with minor exceptions. Flows under H4_ELT in Clear Creek would be similar to flows under Existing Conditions. Flows under H4_ELT in the San Joaquin River at Vernalis would generally be lower (up to 16% lower) than those under Existing Conditions. Flows under H4_ELT in the Stanislaus River at the confluence with the San Joaquin River would generally be up to 14% lower than to those under Existing Conditions.

Based on these flow reductions, juvenile rearing habitat conditions would generally be less favorable under H4 relative to NAA_ELT in the Feather River.

Adults

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the year-round adult largemouth bass residency period would generally be similar to or up to 18% lower than flows under Existing Conditions throughout the year, except during September, when flows would be for 27% and 49% in wet and above normal, respectively (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Differences in flows between H4_ELT and Existing Conditions in the Feather River at Thermalito Afterbay would be highly variable, with flows under H4_ELT up to 509% greater than those under Existing Conditions during April through June and September, except for 37% and 6% lower flows during June of wet and critical water years, respectively, and 49% and 47% lower flows during September of below normal and dry years, respectively. The Feather River flows under H4_ELT would generally be similar to or up to 54% lower than flows under Existing Conditions during July, August, and October through March, except in August through November of critical water years, when flows under H4_ELT would range up to 55% higher. Flows under H4_ELT in the American River at Nimbus Dam would generally be similar to or up to 38% lower than flows under Existing Conditions throughout the year, except for 15% greater flow in January of wet years, 12% to 14% greater flow in February of wet, above normal and below normal water years, and 14% greater flow in October of critical water years. Flows under H4_ELT in the Trinity River would generally be similar to flows under Existing Conditions throughout the year, but would range from 10% to 29% higher during December through March of wet years, would be 22% higher in February of above normal years, would be 16% lower in January of below normal years, and would be 10% lower in July of wet years. Flows under H4_ELT in Clear Creek would generally be similar to flows under Existing Conditions throughout the year, but would be 40% and 13% greater in January and February, respectively, of wet years, would be 10% higher in December through April of critical water years, 11% higher in October of critical years, 13% higher in March of below normal years. Flows under H4_ELT in the San Joaquin River at Vernalis would generally be similar to or slightly lower than those under Existing Conditions during January, April, May and September through

November, would be similar to or up to 23% lower than flows under Existing Conditions during February, March, and June through August, and would be similar to or 12% higher (wet years) in December. Flows under H4_ELT in the Stanislaus River at the confluence with the San Joaquin River would generally be similar to or up to 29% lower than to those under Existing Conditions during January through July, except for 17% and 11% greater flow during February and June, respectively, of wet years, and would be similar to or slightly lower than flows under Existing Conditions during August through December.

Water temperatures in the Feather River below Thermalito Afterbay would not exceed the 86°F water temperature threshold for adult largemouth bass under H4_ELT or Existing Conditions. As a result, there would be no difference between H4_ELT and Existing Conditions in the percentage of months in which the 86°F water temperature threshold is exceeded (Table 11-4A-153).

Summary of CEQA Conclusion

Collectively, flows would be lower under Alternative 4A during the adult largemouth bass residency period relative to Existing Conditions. Flows would be persistently and moderately to substantially lower in several rivers during substantial portions of the period. Therefore, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce the quantity and quality of habitat for adults as a result of flow reductions.

As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows and water temperatures in all rivers would generally be similar between NAA_ELT and Alternative 4A. These modeling results represent the increment of change attributable to the alternative, demonstrating the general similarities in flows and water temperature under Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Sacramento Tule Perch

In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions for Sacramento tule perch relative to the NAA_ELT.

H3_ELT/ESO_ELT

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during year-round juvenile and adult Sacramento tule perch occurrence period. Lower flows could reduce the quantity and quality of instream habitat available for rearing.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT throughout the year with some exceptions (up to 14% lower), and would be lower in all water year types during November (up to 18% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions in drier water years, when effects on habitat conditions would be more critical, would be inconsistent and/or of small magnitude for all months during the rearing period and, therefore, would not have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT during the period, except in above normal years in April and October (17% and 8% lower, respectively), and in wet years during November (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT throughout the year, except in critical years during July (14% lower), August (11% greater), September (10% lower), and October (7% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would generally be lower than flows under NAA during January and July through September, except in critical years in August and September (23% and 25% greater, respectively); would generally be similar to or greater than flows under NAA_ELT during February through June, except for below normal years during February and March (11% and 13% lower, respectively) and in critical years during May and June (10% and 8% lower, respectively); and would generally be similar to or greater than flows under NAA_ELT during November and December, except in wet years during December (5% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows would be more persistently lower under H3_ELT relative to NAA_ELT (up to 48% lower) during July, August, and in all water year types except critical years during September (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions would be partially offset by increases in flow in the adjoining months. In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows under NAA_ELT during January through July and December, except in below normal and critical years during October (11% lower), and would be similar to or lower than flows under NAA_ELT (up to 22% lower) during August through November, except in below normal and critical years during October (16% and 22% greater, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Flow reductions would be offset by increases in some months and/or not persistent within a single water year type. Effects would not be biologically meaningful.

In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River flows under H3_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

The analysis for Alternative 4A indicates that there would be no biologically meaningful differences in flows between H3 and NAA_ELT because flows would not be reduced enough or frequently enough to affect habitat conditions.

Water Temperature

The percentage of months exceeding water temperature thresholds of 72°F and 75°F for the year-round juvenile and adult Sacramento tule perch occurrence period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures exceeding these thresholds could lead to reduced rearing habitat quantity and quality and increased stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT. Therefore, there would be no temperature related effects of H3_ELT in these rivers during any month. In the Feather River below Thermalito Afterbay, the percentage of years under H3_ELT exceeding the 72°F threshold would be higher than the percentage under NAA_ELT by up to 164% depending on water year type (Table 11-4A-154). Although relative differences are large due to small values in the divisor, the absolute differences in percent exceedance are negligible (≤2%) and, therefore, do not represent biologically meaningful effects to Sacramento tule perch.

The percentage of months under H3_ELT exceeding the 75°F threshold would be similar to or up to 29% lower than the percentage under NAA_ELT (Table 11-4A-154). As with the 72°F threshold, although relative differences are large due to small values in the divisor, the absolute differences in percent exceedance are negligible (≤1%) and, therefore, do not represent biologically meaningful effects to Sacramento tule perch.

Table 11-4A-154. Difference and Percent Difference in the Percentage of Months Year-Round in Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed 72°F and 75°F Water Temperature Thresholds for Sacramento Tule Perch Occurrence[a]

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA vs. H3_ELT
72°F Threshold		
Wet	1 (59%)	2 (84%)
Above Normal	0 (NA)	0 (NA)
Below Normal	2 (NA)	2 (NA)
Dry	4 (NA)	2 (164%)
Critical	5 (114%)	1 (18%)
All	2 (185%)	2 (76%)
75°F Threshold		
Wet	0 (NA)	0 (0%)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	3 (400%)	-1 (-29%)
All	1 (500%)	0 (-25%)

NA = could not be calculated because the denominator was 0.

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the year-round juvenile and adult Sacramento tule perch occurrence period would generally be similar to flows under NAA_ELT, except for 10% lower flow during September of below normal water years and except during November of all water year types, when flows would be up to 15% lower (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be up to 548% greater than flows under NAA_ELT during April through June, except for 12% and 10% lower flows during June of wet and critical water years, respectively. The Feather River flows under H4_ELT would generally be similar to or up to 60% lower than flows under NAA_ELT during July through November, except in August through November of critical water years, when flows under NAA_ELT would range from 11% to 52% higher, and the flows would generally be similar to or up to 40% higher under NAA_ELT during December through March.

Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under NAA_ELT throughout the year, except for 14% lower flow in May of critical water years, 28% lower flow in August of critical years, 20% lower flows in September of below normal years, 18% greater flow in August of below normal years, and 15% and 21% greater flows in October of below normal and critical water years, respectively.

Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under NAA_ELT throughout the year, except for 10% higher flow during February of wet years, 17% lower flow during April of above normal water years, 16% greater flow during September of critical years, and 11% greater flow during October of above normal water years.

Flows under H4_ELT in Clear Creek below Whiskeytown would generally be similar to flows under NAA_ELT throughout the year, except for 12% higher flow in March of below normal water years, and 14% lower flow and 11% higher flow during July and August, respectively, of critical water years.

Flows under H4_ELT in the San Joaquin and Stanislaus Rivers would be similar to flows under NAA_ELT throughout the year.

The percentage of months under H4_ELT exceeding the 72°F and 75°F water temperature thresholds in the Feather River below Thermalito Afterbay during the year-round juvenile and adult Sacramento tule perch occurrence period would generally be higher than the percentage under NAA_ELT, but absolute differences would be small (≤4%) and, therefore, would not represent a biologically meaningful effect to Sacramento tule perch (Table 11-4A-155).

Table 11-4A-155. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in the Percentage of Months Year-Round in Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed 72°F and 75°F Water Temperature Thresholds for Sacramento Tule Perch Occurrence[a]

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
72°F Threshold		
Wet	3 (145%)	4 (184%)
Above Normal	2 (NA)	2 (NA)
Below Normal	2 (NA)	2 (NA)
Dry	5 (NA)	3 (229%)
Critical	7 (164%)	4 (46%)
All	4 (292%)	3 (143%)
75°F Threshold		
Wet	1 (NA)	1 (233%)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	1 (NA)	1 (NA)
Critical	2 (300%)	-2 (-43%)
All	1 (700%)	0 (0%)

NA = could not be calculated because the denominator was 0.

[a] A negative value indicates a reduction in percentage of months outside suitable range under H4_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 4A would not cause a substantial reduction in the quantity or quality of Sacramento tule perch habitat. Flows in all rivers examined during the year under Alternative 4A are generally similar to or greater than flows under the NAA_ELT in most months. Flows in July or August through November are more likely to be lower for some water year types in some of the locations analyzed, however they are generally of small magnitude, not consistent from month to month within a specific water year type, and/or would be offset by increases in flow in the adjoining months. Therefore, the flow reductions are not expected to have biologically meaningful negative effects on the Sacramento tule perch population. There would be no substantial differences in water temperature between Alternative 4A and NAA_ELT in any river examined that would cause a biologically meaningful effect to Sacramento tule perch.

CEQA Conclusion: In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions for Sacramento tule perch relative to Existing Conditions.

H3_ELT/ESO_ELT

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during year-round juvenile and adult Sacramento tule perch occurrence period. Lower flows could reduce the quantity and quality of instream habitat available for tule perch.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during January through April and December, except in drier years during January (to 13% lower), in dry and critical years during February (8% and 6% lower, respectively), in critical years during March (8% lower), in above normal years in April (5% lower), and in dry and critical years during December (8% and 5% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows would generally be similar to or lower than flows under Existing Conditions during May through November (to 46% lower), except in critical years during May (13% greater), in below normal and dry years during June (8% and 25% greater, respectively), and in below normal and critical years during October (10% and 15% greater, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). There would be primarily small flow reductions in some water year types for some months, but not persistent enough and of a magnitude that would not be expected to have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during January through June and December, except in below normal years during January (16% lower), in below normal years during March (6% lower), and in critical years during May (6% lower), but would generally be similar to or lower than flows under Existing Conditions during July through November, except in below normal years during July (5% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). The persistent, small to moderate flow reductions would have a localized effect on habitat conditions in that water year type.

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows under Existing Conditions throughout the year, except in critical years during September and in below normal years during October (19% and 6% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). This flow reduction is a relatively isolated effect limited to a single water year type in each month and would not be expected to have biologically meaningful negative effects.

In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under Existing Conditions during February through June, September, and October, except in drier years during February (to 48% lower), in below normal and dry years during March (39% and 17% lower, respectively), in below normal years during April (6% lower), in wet years during May (15% lower), in below normal and critical years during September (26% and 50% lower, respectively), and in wet and critical years during October (6% and 7% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3_ELT would generally be moderately to substantially lower than flows under Existing Conditions in January, July, August, November, and December, except in wet and above normal years during July (15% and 9% greater, respectively), in below normal and dry years during August (7% and 45% greater, respectively), in above normal years during November (5% greater), and in above normal years during December (18% greater) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions in wetter years during January, in wet and below normal years during December, and in most water year types during February through April, except in dry and critical years during February (8% and 6% lower, respectively), in critical years during March (7% lower), and in above normal years during April (5% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3_ELT would generally be similar to or lower than flows under Existing Conditions during May through November, except in critical years during May (13% greater), in below normal and dry years during June (8% and 25% greater, respectively), and in below normal and critical years during October (10% and 15% greater, respectively). There would be persistent small to substantial flow reductions that would affect habitat conditions at this location.

In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly lower than those under Existing Conditions during April, May and September through November, would be similar to or up to 23% lower than flows under Existing Conditions during February, March, and June through August, and would be similar to or up to 11% greater than flows under Existing Conditions during December and January.

In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would generally be similar to or up to 29% lower than to those under Existing Conditions during January through July, except for 17% and 11% greater flow in wet years during February and June, respectively, and would be similar to or slightly lower than flows under Existing Conditions during August through December.

Water Temperature

The percentage of months exceeding water temperatures of 72°F and 75°F for the year-round juvenile and adult Sacramento tule perch occurrence period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures exceeding these thresholds could lead to reduced habitat quality and increased stress and mortality. Water temperatures were not modeled in Clear Creek or the San Joaquin River.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under Existing Conditions. Therefore, there would be no temperature related effects of H3_ELT in these rivers during any month. In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT exceeding 72°F relative to the percentage under Existing Conditions would be similar to or greater, by up to 114% (Table 11-4A-154). However, these relative increases correspond to small absolute increases (≤5%) that are not expected to have biologically meaningful effects.

The percentage of years under H3_ELT exceeding 75°F would be similar to the percentage under Existing Conditions in all water years except critical years (400% higher) (Table 11-4A-154). As with the 72°F threshold, this increase corresponds to a small absolute increase (3%) that is not expected to have biologically meaningful negative effects.

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the year-round juvenile and adult Sacramento tule perch occurrence period would generally be similar to or up to 18% lower than flows under Existing Conditions throughout the year, except during September, when flows would be for 27% and 49% in wet and above normal, respectively (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Differences in flows between H4_ELT and Existing Conditions in the Feather River at Thermalito Afterbay would be highly variable, with flows under H4_ELT up to 509% greater than those under Existing Conditions during April through June and September, except for 37% and 6% lower flows during June of wet and critical water years, respectively, and 49% and 47% lower flows during September of below normal and dry years, respectively. The Feather River flows under H4_ELT would generally be similar to or up to 54% lower than flows under Existing Conditions during July, August, and October through March, except in August through November of critical water years, when flows under H4_ELT would range up to 55% higher. Flows under H4_ELT in the American River at Nimbus Dam would generally be similar to or up to 38% lower than flows under Existing Conditions throughout the year, except for 15% greater flow in January of wet years, 12% to 14% greater flow in February of wet, above normal and below normal water years, and 14% greater flow in October of critical water years. Flows under H4_ELT in the Trinity River would generally be similar to flows under Existing Conditions throughout the year, but would range from 10% to 29% higher during December through March of wet years, would be 22% higher in February of above normal years, would be 16% lower in January of below normal years, and would be 10% lower in July of wet years. Flows under H4_ELT in Clear Creek would generally be similar to flows under Existing Conditions throughout the year, but would be 40% and 13% greater in January and February, respectively, of wet years, would be 10% higher in December through April of critical water years, 11% higher in October of critical years, 13% higher in March of below normal years. Flows under H4_ELT in the San Joaquin River at Vernalis would generally be similar to or slightly lower than those under Existing Conditions during January, April, May and September through November, would be similar to or up to 23% lower than flows under Existing Conditions during February, March, and June through August, and would be similar to or 12% higher (wet years) in December. Flows under H4_ELT in the Stanislaus River at the confluence with the San Joaquin River would generally be similar to or up to 29% lower than to those under Existing Conditions during January through July, except for 17% and 11% greater flow during February and June, respectively, of wet years, and would be similar to or slightly lower than flows under Existing Conditions during August through December.

The percentage of months under H4_ELT exceeding the 72°F and 75°F water temperature thresholds in the Feather River below Thermalito Afterbay during the year-round juvenile and adult Sacramento tule perch occurrence period would generally be similar to those under Existing Conditions, except in wet and critical years for the 72°F threshold and in critical years for the 75°F threshold. Although these relative differences would be large, the absolute differences would be small (≤7%) and, therefore, would not have a biologically meaningful effect on the quantity or quality of habitat for Sacramento tule perch (Table 11-4A-155).

Summary of CEQA Conclusion

Collectively, flows would be lower under Alternative 4A during the juvenile and adult Sacramento tule perch occurrence period relative to Existing Conditions. Flows would be persistently and moderately to substantially lower in several rivers during substantial portions of the period. Therefore, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce suitable rearing habitat as a result of flow reductions.

As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows and water temperatures in all rivers would generally be similar between NAA_ELT and Alternative 4A. These modeling results represent the increment of change attributable to the alternative, demonstrating the general similarities in flows and water temperature under Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Sacramento-San Joaquin Roach

In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions for Sacramento-San Joaquin roach relative to the NAA_ELT.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the year-round juvenile and adult Sacramento-San Joaquin roach occurrence period. Lower flows could reduce the quantity and quality of instream habitat for juvenile and adult Sacramento-San Joaquin roach.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT throughout the year with some exceptions (up to 14% lower), and would be lower in all water year types during November (up to 18% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions in drier water years, when effects on habitat conditions would be more critical, would be inconsistent and/or of small magnitude for all months during the rearing period and, therefore, would not have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT during the period, except in above normal years in April and October (17% and 8% lower, respectively), and in wet years during November (10% lower)(Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT throughout the year, except in critical years during July (14% lower), August (11% greater), September (10% lower), and October (7% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would generally be lower than flows under NAA_ELT during January and July through September, except in critical years in August and September (23% and 25% greater, respectively); would generally be similar to or greater than flows under NAA_ELT during February through June, except for below normal years during February and March (11% and 13% lower, respectively) and in critical years during May and June (10% and 8% lower, respectively); and would generally be similar to or greater than flows under NAA_ELT during November and December, except in wet years during December (5% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows would be more persistently lower under H3_ELT relative to NAA_ELT (up to 48% lower) during July, August, and in all water year types except critical years during September. Flow reductions would be partially offset by increases in flow in the adjoining months.

In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows under NAA_ELT during January through July and December, except in below normal and critical years during October (11% lower), and would be similar to or lower than flows under NAA_ELT (up to 22% lower) during August through November, except in below normal and critical years during October (16% and 22% greater, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions would be offset by increases in some months and/or not persistent within a single water year type. Effects would not be biologically meaningful.

In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River flows under H3_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

Water Temperature

The percentage of months above the 86°F water temperature threshold for year-round juvenile and adult Sacramento-San Joaquin roach occurrence period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Elevated water temperatures could lead to reduced rearing habitat quality and increased stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3 _ELT would generally be the same as those under NAA _ELT. Therefore, there would be no temperature related effects of H3 _ELT in these rivers during any month.

In the Feather River below Thermalito Afterbay, water temperatures would not exceed 86°F under NAA_ELT or H3_ELT (Table 11-4A-156). As a result, there would be no difference in the percentage of months in which the 86°F water temperature threshold is exceeded between NAA_ELT and H3_ELT.

Table 11-4A-156. Difference and Percent Difference in the Percentage of Months Year-Round in Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed the 86°F Water Temperature Threshold for Sacramento-San Joaquin Roach Survival[a]

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the year-round Sacramento-San Joaquin roach occurrence period would generally be similar to flows under NAA_ELT, except for 10% lower flow during September of below normal water years and except during November of all water year types, when flows would be up to 15% lower (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be up to 548% greater than flows under NAA_ELT during April through June, except for 12% and 10% lower flows during June of wet and critical water years, respectively. The Feather River flows under H4_ELT would generally be similar to or up to 60% lower than flows under NAA_ELT during July through November, except in August through November of critical water years, when flows under NAA_ELT would range from 11% to 52% higher, and the flows would generally be similar to or up to 40% higher under NAA_ELT during December through March. Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under NAA_ELT throughout the year, except for 14% lower flow in May of critical water years, 28% lower flow in August of critical years, 20% lower flows in September of below normal years, 18% greater flow in August of below normal years, and 15% and 21% greater flows in October of below normal and critical water years, respectively. Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under NAA_ELT throughout the year, except for 10% higher flow during February of wet years, 17% lower flow during April of above normal water years, 16% greater flow during September of critical years, and 11% greater flow during October of above normal water years. Flows under H4_ELT in Clear Creek below Whiskeytown would generally be similar to flows under NAA_ELT throughout the year, except for 12% higher flow in March of below normal water years, and 14% lower flow and 11% higher flow during July and August, respectively, of critical water years. Flows under H4_ELT in the San Joaquin and Stanislaus Rivers would be similar to flows under NAA_ELT throughout the year.

Water temperatures in the Feather River below Thermalito Afterbay during the year-round Sacramento-San Joaquin roach occurrence period would not exceed the 86°F water temperature threshold in H4_ELT or NAA_ELT. As a result, there would be no difference between H4_ELT and NAA_ELT in the percentage of months in which the 86°F water temperature threshold is exceeded (Table 11-4A-157).

Table 11-4A-157. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in the Percentage of Months Year-Round in Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed the 86°F Water Temperature Threshold for Sacramento-San Joaquin Roach Survival[a]

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

[a] A negative value indicates a reduction in percentage of months outside suitable range for H4_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 4A would not cause a substantial reduction in quantity and quality of habitat for juvenile and adult Sacramento-San Joaquin roach rearing habitat. Flows in all rivers examined during the year under Alternative 4A are generally similar to or greater than flows under the NAA_ELT in most months. Flows in July or August through November are more likely to be lower for some water year types in some of the locations analyzed, however they are generally of small magnitude, not consistent from month to month within a specific water year type, and/or would be offset by increases in flow in the adjoining months. Therefore, the flow reductions are not expected to have biologically meaningful negative effects on the Sacramento-San Joaquin roach population. Flow-related habitat conditions for roach under H4_ELT would be less favorable than those under H3_ELT although not different from NAA_ELT. There are no temperature-related effects in any other rivers examined.

CEQA Conclusion: In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions for Sacramento-San Joaquin roach relative to Existing Conditions.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the year-round juvenile and adult Sacramento-San Joaquin roach occurrence period. Lower flows could reduce the quantity and quality of instream habitat for juvenile and adult Sacramento-San Joaquin roach.

In the Sacramento River upstream of Red Bluff, flows under H4_ELTwould generally be similar to or greater than flows under Existing Conditions during January through April and December, except in drier years during January (to 13% lower), in dry and critical years during February (8% and 6% lower, respectively), in critical years during March (8% lower), in above normal years in April (5% lower), and in dry and critical years during December (8% and 5% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows would generally be similar to or lower than flows under Existing Conditions during May through November (to 46% lower), except in critical years during May (13% greater), in below normal and dry years during June (8% and 25% greater, respectively), and in below normal and critical years during October (10% and 15% greater, respectively). There would be primarily small flow reductions in some drier water year types for some months, but not persistent enough and of a magnitude that would not be expected to have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during January through June and December, except in below normal years during January (16% lower), in below normal years during March (6% lower), and in critical years during May (6% lower), but would generally be similar to or lower than flows under Existing Conditions during July through November, except in below normal years during July (5% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). The persistent, small to moderate flow reductions in critical years would have a localized effect on habitat conditions in that water year type.

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows under Existing Conditions throughout the year, except in critical years during September and in below normal years during October (19% and 6% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). This flow reduction is a relatively isolated effect limited to a single water year type in each month and would not be expected to have biologically meaningful negative effects.

In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under Existing Conditions during February through June, September, and October, except in drier years during February (to 48% lower), in below normal and dry years during March (39% and 17% lower, respectively), in below normal years during April (6% lower), in wet years during May (15% lower), in below normal and critical years during September (26% and 50% lower, respectively), and in wet and critical years during October (6% and 7% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3_ELT would generally be moderately to substantially lower than flows under Existing Conditions in January, July, August, November, and December, except in wet and above normal years during July (15% and 9% greater, respectively), in below normal and dry years during August (7% and 45% greater, respectively), in above normal years during November (5% greater), and in above normal years during December (18% greater).

In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions in wetter years during January, in wet and below normal years during December, and in most water year types during February through April, except in dry and critical years during February (8% and 6% lower, respectively), in critical years during March (7% lower), and in above normal years during April (5% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3_ELT would generally be similar to or lower than flows under Existing Conditions during May through November, except in critical years during May (13% greater), in below normal and dry years during June (8% and 25% greater, respectively), and in below normal and critical years during October (10% and 15% greater, respectively). There would be moderate flow reductions in drier water year types, when effects would be most critical for habitat conditions, for some months/water year types from May through November that would affect rearing conditions at this location. There would be persistent small to substantial flow reductions that would affect habitat conditions at this location.

In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly lower than those under Existing Conditions during April, May and September through November, would be similar to or up to 23% lower than flows under Existing Conditions during February, March, and June through August, and would be similar to or up to 11% greater than flows under Existing Conditions during December and January.

In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would generally be similar to or up to 29% lower than to those under Existing Conditions during January through July, except for 17% and 11% greater flow in wet years during February and June, respectively, and would be similar to or slightly lower than flows under Existing Conditions during August through December.

Water Temperature

The percentage of months above the 86°F water temperature threshold for year-round juvenile and adult Sacramento-San Joaquin roach occurrence period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Elevated water temperatures could lead to reduced quantity and quality of habitat and increased stress and mortality for juvenile and adult Sacramento-San Joaquin roach. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT. Therefore, there would be no temperature related effects of H3_ELT in these rivers during any month.

In the Feather River below Thermalito Afterbay, water temperatures would not exceed the 86°F water temperature threshold for Sacramento-San Joaquin roach under Existing Conditions or H3_ELT (Table 11-4A-156). As a result, there would be no difference in the percentage of months in which the 86°F water temperature threshold is exceeded between H3_ELT and Existing Conditions.

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the year-round juvenile and adult Sacramento-San Joaquin roach occurrence period would generally be similar to or up to 18% lower than flows under Existing Conditions throughout the year, except during September, when flows would be for 27% and 49% in wet and above normal, respectively (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Differences in flows between H4_ELT and Existing Conditions in the Feather River at Thermalito Afterbay would be highly variable, with flows under H4_ELT up to 509% greater than those under Existing Conditions during April through June and September, except for 37% and 6% lower flows during June of wet and critical water years, respectively, and 49% and 47% lower flows during September of below normal and dry years, respectively. The Feather River flows under H4_ELT would generally be similar to or up to 54% lower than flows under Existing Conditions during July, August, and October through March, except in August through November of critical water years, when flows under H4_ELT would range up to 55% higher. Flows under H4_ELT in the American River at Nimbus Dam would generally be similar to or up to 38% lower than flows under Existing Conditions throughout the year, except for 15% greater flow in January of wet years, 12% to 14% greater flow in February of wet, above normal and below normal water years, and 14% greater flow in October of critical water years. Flows under H4_ELT in the Trinity River would generally be similar to flows under Existing Conditions throughout the year, but would range from 10% to 29% higher during December through March of wet years, would be 22% higher in February of above normal years, would be 16% lower in January of below normal years, and would be 10% lower in July of wet years. Flows under H4_ELT in Clear Creek would generally be similar to flows under Existing Conditions throughout the year, but would be 40% and 13% greater in January and February, respectively, of wet years, would be 10% higher in December through April of critical water years, 11% higher in October of critical years, 13% higher in March of below normal years. Flows under H4_ELT in the San Joaquin River at Vernalis would generally be similar to or slightly lower than those under Existing Conditions during January, April, May and September through November, would be similar to or up to 23% lower than flows under Existing Conditions during February, March, and June through August, and would be similar to or 12% higher (wet years) in December. Flows under H4_ELT in the Stanislaus River at the confluence with the San Joaquin River would generally be similar to or up to 29% lower than to those under Existing Conditions during January through July, except for 17% and 11% greater flow during February and June, respectively, of wet years, and would be similar to or slightly lower than flows under Existing Conditions during August through December.

Water temperatures in the Feather River below Thermalito Afterbay during the year-round juvenile and adult Sacramento-San Joaquin roach occurrence period would not exceed the 86°F water temperature threshold in H4_ELT or Existing Conditions. As a result, there would be no difference between H4_ELT and Existing Conditions in the percentage of months in which the 86°F water temperature threshold is exceeded (Table 11-4A-157).

Summary of CEQA Conclusion

Collectively, flows would be lower under Alternative 4A during the year-round juvenile and adult Sacramento-San Joaquin roach occurrence period relative to Existing Conditions. Flows would be persistently and moderately to substantially lower in several rivers during substantial portions of the rearing period. Therefore, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce suitable rearing habitat as a result of flow reductions.

As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows and water temperatures in all rivers would generally be similar between NAA_ELT and Alternative 4A. These modeling results represent the increment of change attributable to the alternative, demonstrating the general similarities in flows and water temperature under Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Hardhead

In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions for hardhead relative to the NAA.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the year-round juvenile and adult hardhead occurrence period. Lower flows could reduce the quantity and quality of instream habitat available for juvenile and adult hardhead.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT throughout the year with some exceptions (up to 14% lower), and would be lower in all water year types during November (up to 18% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions in drier water years, when effects on habitat conditions would be more critical, would be inconsistent and/or of small magnitude for all months during the rearing period and, therefore, would not have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT during the period, except in above normal years in April and October (17% and 8% lower, respectively), and in wet years during November (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT throughout the year except in critical years during July (14% lower), August (11% greater), September (10% lower), and October (7% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would generally be lower than flows under NAA_ELT during January and July through September, except in critical years during August and September (23% and 25% greater, respectively); would generally be similar to or greater than flows under NAA_ELT during February through June, except for below normal years during February and March (11% and 13% lower, respectively) and in critical years during May and June (10% and 8% lower, respectively); and would generally be similar to or greater than flows under NAA_ELT during November and December, except in wet years during December (5% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows would be more persistently lower under H3_ELT relative to NAA_ELT (up to 48% lower) during July, August, and in all water year types except critical years during September (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions would be partially offset by increases in flow in the adjoining months.

In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows under NAA_ELT during January through July and December, except in below normal years during January (to 11% lower), and would be similar to or lower than flows under NAA_ELT (up to 22% lower) during August through November, except in below normal and critical years during October (16% and 22% greater, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions would be offset by increases in some months and/or not persistent within a single water year type. Effects would not be biologically meaningful.

In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River flows under H3_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

Water Temperature

The percentage of months outside of the 65°F to 82.4°F suitable water temperature range for juvenile and adult hardhead was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced rearing habitat quality and increased stress and mortality for juvenile and adult hardhead. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT. Therefore, there would be no temperature related effects of H3_ELT in these rivers during any month.

In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT outside the range would be similar to or lower than the percentage under NAA_ELT in all water year except below normal years (6% greater) (Table 11-4A-158).

Table 11-4A-158. Difference and Percent Difference in the Percentage of Months Year-Round in Which Water Temperatures in the Feather River below Thermalito Afterbay Are outside the 65°F to 82.4°F Water Temperature Range for Juvenile and Adult Hardhead Occurrence[a]

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	0 (0%)	1 (1%)
Above Normal	-3 (-4%)	-3 (-4%)
Below Normal	0 (0%)	4 (6%)
Dry	-1 (-1%)	0 (0%)
Critical	-4 (-6%)	-2 (-3%)
All	0 (0%)	1 (1%)

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the year-round juvenile and adult hardhead occurrence period would generally be similar to flows under NAA_ELT, except for 10% lower flow during September of below normal water years and except during November of all water year types, when flows would be up to 15% lower (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be up to 548% greater than flows under NAA_ELT during April through June, except for 12% and 10% lower flows during June of wet and critical water years, respectively. The Feather River flows under H4_ELT would generally be similar to or up to 60% lower than flows under NAA_ELT during July through November, except in August through November of critical water years, when flows under NAA_ELT would range from 11% to 52% higher, and the flows would generally be similar to or up to 40% higher under NAA_ELT during December through March. Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under NAA_ELT throughout the year, except for 14% lower flow in May of critical water years, 28% lower flow in August of critical years, 20% lower flows in September of below normal years, 18% greater flow in August of below normal years, and 15% and 21% greater flows in October of below normal and critical water years, respectively. Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under NAA_ELT throughout the year, except for 10% higher flow during February of wet years, 17% lower flow during April of above normal water years, 16% greater flow during September of critical years, and 11% greater flow during October of above normal water years. Flows under H4_ELT in Clear Creek below Whiskeytown would generally be similar to flows under NAA_ELT throughout the year, except for 12% higher flow in March of below normal water years, and 14% lower flow and 11% higher flow during July and August, respectively, of critical water years. Flows under H4_ELT in the San Joaquin and Stanislaus Rivers would be similar to flows under NAA_ELT throughout the year.

The percentage of months under H4_ELT outside the 65°F to 82.4°F water temperature range in the Feather River below Thermalito Afterbay during the year-round juvenile and adult hardhead occurrence period would be similar to or lower than the percentage under Existing Conditions in all water year types (Table 11-4A-159).

Table 11-4A-159. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in the Percentage of Months Year-Round in Which Water Temperatures in the Feather River below Thermalito Afterbay Are outside the 65°F to 82.4°F Water Temperature Range for Juvenile and Adult Hardhead Occurrence[a]

Water Year Type	EXISTING CONDITIONS	NAA_ELT vs. H4_ELT
Wet	-2 (-3%)	-1 (-1%)
Above Normal	0 (0%)	0 (0%)
Below Normal	-4 (-6%)	0 (0%)
Dry	-1 (-1%)	0 (0%)
Critical	-4 (-6%)	-2 (-3%)
All	-2 (-3%)	-1 (-1%)

[a] A negative value indicates a reduction in percentage of months outside suitable range for H4_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 4A would not cause a substantial reduction in the quantity or quality of habitat for juvenile and adult hardhead. Flows in all rivers examined during the year under Alternative 4A are generally similar to or greater than flows under the NAA_ELT in most months. Flows in July or August through November are more likely to be lower for some water year types in some of the locations analyzed, however they are generally of small magnitude, not consistent from month to month within a specific water year type, and/or would be offset by increases in flow in the adjoining months. Therefore, the flow reductions are not expected to have biologically meaningful negative effects on hardhead. Flow-related habitat conditions for hardhead under H4_ELT would be less favorable than those under H3_ELT although not different from NAA_ELT. There are no temperature-related effects in any other rivers examined.

CEQA Conclusion: In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions for juvenile and adult hardhead relative to Existing Conditions.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the year-round juvenile and adult hardhead occurrence period. Lower flows could reduce the quantity and quality of instream habitat for juvenile and adult hardhead.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during January through April and December, except in drier years during January (to 13% lower), in dry and critical years during February (8% and 6% lower, respectively), in critical years during March (8% lower), in above normal years in April (5% lower), and in dry and critical years during December (8% and 5% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows would generally be similar to or lower than flows under Existing Conditions during May through November (to 46% lower), except in critical years during May (13% greater), in below normal and dry years during June (8% and 25% greater, respectively), and in below normal and critical years during October (10% and 15% greater, respectively). There would be primarily small flow reductions in some drier water year types for some months, but not persistent enough and of a magnitude that would not be expected to have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during January through June and December, except in below normal years during January (16% lower), in below normal years during March (6% lower), and in critical years during May (6% lower), but would generally be similar to or lower than flows under Existing Conditions during July through November, except in below normal years during July (5% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). The persistent, small to moderate flow reductions in critical years would have a localized effect on rearing conditions in that water year type. In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows under Existing Conditions throughout the year, except in critical years during September and in below normal years during October (19% and 6% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). This flow reduction is a relatively isolated effect limited to a single water year type in each month and would not be expected to have biologically meaningful negative effects.

In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under Existing Conditions during February through June, September, and October, except in drier years during February (to 48%), in below normal and dry years during March (39% and 17% lower, respectively), in below normal years during April (6% lower), in wet years during May (155 lower), in below normal and critical years during September (26% and 50% lower, respectively), and in wet and critical years during October (6% and 7% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3_ELT would generally be moderately to substantially lower than flows under Existing Conditions in January, July, August, November, and December, except in wet and above normal years during July (15% and 9% greater, respectively), in below normal and dry years during August (7% and 45% greater, respectively), in above normal years during November (5% greater), and in above normal years during December (18% greater).

In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions in wetter years during January, in wet and below normal years during December, and in most water year types during February through April, except in dry and critical years during February (8% and 6% lower, respectively), in critical years during March (7% lower), and in above normal years during April (5% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3_ELT would generally be similar to or lower than flows under Existing Conditions during May through November, except in critical years during May (13% greater), in below normal and dry years during June (8% and 25% greater, respectively), and in below normal and critical years during October (10% and 15% greater, respectively). The persistent, small to moderate flow reductions in critical years would have a localized effect on habitat conditions in that water year type.

In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly lower than those under Existing Conditions during April, May and September through November, would be similar to or up to 23% lower than flows under Existing Conditions during February, March, and June through August, and would be similar to or up to 11% greater than flows under Existing Conditions during December and January.

In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would generally be similar to or up to 29% lower than to those under Existing Conditions during January through July, except for 17% and 11% greater flow in wet years during February and June, respectively, and would be similar to or slightly lower than flows under Existing Conditions during August through December.

Water Temperature

The percentage of months in which year-round in-stream temperatures would be outside of the 65°F to 82.4°F suitable water temperature range for juvenile and adult hardhead was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced rearing habitat quality and increased stress and mortality for juvenile and adult hardhead. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under Existing Conditions. Therefore, there would be no temperature related effects of H3_ELT in these rivers during any month.

In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT outside of the 65°F to 82.4°F suitable water temperature range for juvenile and adult hardhead would be similar to or lower than the percentage under Existing Conditions in all water years (Table 11-4A-158).

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the year-round juvenile and adult hardhead occurrence period would generally be similar to or up to 18% lower than flows under Existing Conditions throughout the year, except during September, when flows would be for 27% and 49% in wet and above normal, respectively (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Differences in flows between H4_ELT and Existing Conditions in the Feather River at Thermalito Afterbay would be highly variable, with flows under H4_ELT up to 509% greater than those under Existing Conditions during April through June and September, except for 37% and 6% lower flows during June of wet and critical water years, respectively, and 49% and 47% lower flows during September of below normal and dry years, respectively. The Feather River flows under H4_ELT would generally be similar to or up to 54% lower than flows under Existing Conditions during July, August, and October through March, except in August through November of critical water years, when flows under H4_ELT would range up to 55% higher. Flows under H4_ELT in the American River at Nimbus Dam would generally be similar to or up to 38% lower than flows under Existing Conditions throughout the year, except for 15% greater flow in January of wet years, 12% to 14% greater flow in February of wet, above normal and below normal water years, and 14% greater flow in October of critical water years. Flows under H4_ELT in the Trinity River would generally be similar to flows under Existing Conditions throughout the year, but would range from 10% to 29% higher during December through March of wet years, would be 22% higher in February of above normal years, would be 16% lower in January of below normal years, and would be 10% lower in July of wet years. Flows under H4_ELT in Clear Creek would generally be similar to flows under Existing Conditions throughout the year, but would be 40% and 13% greater in January and February, respectively, of wet years, would be 10% higher in December through April of critical water years, 11% higher in October of critical years, 13% higher in March of below normal years. Flows under H4_ELT in the San Joaquin River at Vernalis would generally be similar to or slightly lower than those under Existing Conditions during January, April, May and September through

November, would be similar to or up to 23% lower than flows under Existing Conditions during February, March, and June through August, and would be similar to or 12% higher (wet years) in December. Flows under H4_ELT in the Stanislaus River at the confluence with the San Joaquin River would generally be similar to or up to 29% lower than to those under Existing Conditions during January through July, except for 17% and 11% greater flow during February and June, respectively, of wet years, and would be similar to or slightly lower than flows under Existing Conditions during August through December.

The percentage of months under H4_ELT outside the 65°F to 82.4°F water temperature range in the Feather River below Thermalito Afterbay during the year-round juvenile and adult hardhead occurrence period would be similar to or less than the percentage under Existing Conditions in all water year types (Table 11-4A-159).

Summary of CEQA Conclusion

Collectively, flows would be lower under Alternative 4A during the juvenile and adult hardhead occurrence period relative to Existing Conditions. Flows would be persistently and moderately to substantially lower in several rivers during substantial portions of the rearing period. Therefore, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce habitat for juvenile and adult hardhead as a result of flow reductions.

As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows and water temperatures in all rivers would generally be similar between NAA_ELT and Alternative 4A. These modeling results represent the increment of change attributable to the alternative, demonstrating the general similarities in flows and water temperature under Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

California Bay Shrimp

NEPA Effects: As discussed further in Chapter 11, Section 11.3.5, in Appendix A, water operations have the potential to affect California bay shrimp juvenile abundance through because of an increase in residual circulation in the estuary with increasing outflow (as indexed by X2) that could translate to more rapid or more complete entrainment into the estuary, or more rapid transport to rearing grounds, both of which presumably could increase survival from hatching to settlement (Kimmerer et al. 2009). An X2-abundance index relationship from Kimmerer et al. (2009) was applied to bay shrimp in order to assess the potential effects on abundance through changes in rearing habitat. Application of these relationships suggested that, in relation to NAA_ELT, there would be only a small change in mean abundance index (<5%) as a result of change in rearing habitat under Alternative 4A scenarios H3_ELT and H4_ELT(See Table 11-mult-13 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS). These modeling results indicate that the operational effects would not be adverse, because they would not result in a substantial reduction in the rearing habitat for California bay shrimp.

CEQA Conclusion: Similar to striped bass and American shad, the analysis of potential water operations-related rearing habitat effects illustrated that in relation to Existing Conditions, there could be a greater impact of Alternative 4A on abundance of California bay shrimp (Table 11-mult-13 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS), than found in the NEPA Effects section. As noted for striped bass and American shad, the comparison to the NAA_ELT is a better approach than comparison to Existing Conditions because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands. In the case of the X2-related analyses of rearing habitat for California bay shrimp and as noted for striped bass and American shad, the effect of sea level rise in particular confounds the interpretation of the effects of the alternatives. Based on the discussion presented above for the NEPA Effects, the change in rearing habitat would be less than significant. No mitigation would necessary.

Impact AQUA-204: Effects of Water Operations on Migration Conditions for Non-Covered Aquatic Species of Primary Management Concern

See Alternative 1A, Impact AQUA-204 for additional background information relevant to non-covered species of primary management concern.

Striped Bass

NEPA Effects: Under Alternative 4A Scenario H3_ELT, average spring (March–May) monthly flows in the Sacramento River downstream of the north Delta intake would be reduced 18–22% during the adult striped bass migration compared to baseline (NAA_ELT). The reduction would be less (4–18%) for the H4_ELT scenario. Sacramento River flows are highly variable inter-annually, but striped bass are still able to migrate upstream the Sacramento River during years of lower flows. The effect of reduced Sacramento flows under Alternative 4A would not be adverse.

CEQA Conclusion: Impacts would be as described immediately above and would be less than significant because the changes in spring flow under Scenarios H3_ELT (21–23% lower compared to Existing Conditions) and H4_ELT (10–18% lower compared to Existing Conditions) would not interfere substantially with movement of pre-spawning striped bass through the Delta. No mitigation would be required.

American Shad

NEPA Effects: Flows in the Sacramento River below the north Delta diversion facilities under Scenarios H3_ELT and H4_ELT would be reduced 18–22% and 4–18%, respectively, relative to the NEPA point of comparison (NAA_ELT) during March–May, as described above for striped bass. River flows are highly variable inter-annually, and American shad are still able to migrate upstream the Sacramento River during lower flow years. Overall, the impact to American shad migration habitat conditions would not be adverse under Alternative 4A.

CEQA Conclusion: Impacts would be as described immediately above and would be less than significant because, as described above for striped bass, the changes in flow under Scenario H3_ELT (21–23% lower compared to Existing Conditions) and H4_ELT (10–18% lower compared to Existing Conditions) would not interfere substantially with movement of American shad from the Delta to upstream spawning habitat. No mitigation would be required.

Threadfin Shad

NEPA Effects: Threadfin shad are semi-anadromous, moving between freshwater and brackish water habitats. Threadfin shad found in the Delta do not actively migrate upstream to spawn. Therefore there is no effect on migration habitat conditions.

CEQA Conclusion: Impacts would be as described immediately above and would be less than significant because flow changes in the Delta under Alternative 4 would not alter movement patterns for threadfin shad. No mitigation would be required.

Largemouth Bass

NEPA Effects: Largemouth bass are non-migratory fish within the Delta. Therefore they do not use the Delta as a migration habitat corridor. There would be no effect.

CEQA Conclusion: As described immediately above, flow changes under Alternative 4 would not affect largemouth movements within the Delta. Therefore, the impact is less than significant. No mitigation would be required.

Sacramento Tule Perch

NEPA Effects: Similar with largemouth bass, Sacramento tule perch are a non-migratory species and do not use the Delta as a migration corridor as they are a resident Delta species. There would be no effect.

CEQA Conclusion: As described immediately above, flow changes would not affect Sacramento tule perch movements within the Delta. Therefore, the impact is less than significant. No mitigation would be required.

Sacramento-San Joaquin Roach

NEPA Effects: For Sacramento-San Joaquin roach, the overall flows and temperature in upstream rivers during migration to their spawning grounds would be similar to those described under Alternative 4, Impact AQUA-202 for spawning. As described there, the flows would slightly improve the upstream conditions relative to the NAA_ELT. These conditions would not be adverse.

CEQA Conclusion: As described in Alternative 4, Impact AQUA-202, the impacts of water operations on migration conditions for Sacramento-San Joaquin roach would be less than significant and no mitigation would be required.

Hardhead

NEPA Effects: For hardhead the overall flows and temperature in upstream rivers during migration to their spawning grounds would be similar to those described under Alternative 4, Impact AQUA-202 for spawning due to similar flows and temperatures. As described there, the flows would slightly improve the upstream conditions relative to the NAA_ELT. These conditions would not be adverse.

CEQA Conclusion: As described immediately above, the impacts of water operations on migration conditions for hardhead would be less than significant and no mitigation would be required.

California Bay Shrimp

NEPA Effects: The effect of water operations on migration conditions of California bay shrimp under Alternative 4A would be similar to that described for Alternative 1A (see Alternative 1A, Impact AQUA-204) due to similar flows and temperatures. For a detailed discussion, please see Alternative 1A, Impact AQUA-204. The effects would not be adverse.

CEQA Conclusion: As described above the impacts on California bay shrimp migration conditions would be less than significant and no mitigation would be required.

Restoration Measures (Environmental Commitment Environmental Commitment 4, Environmental Commitment 6, Environmental Commitment 7, and Environmental Commitment 10)

As noted previously, Alternative 4A includes a greatly reduced extent of restoration measures relative to Alternative 4 and Alternative 1A, upon which the discussion of impacts for Alternative 4 is based. In particular, *Environmental Commitment 4 Tidal Natural Communities Restoration* is reduced from 65,000 acres to 59 acres, so that any impacts would be extremely small. The effects of restoration measures under Alternative 4A would be similar for all non-covered species; therefore, the analysis below is combined for all non-covered species instead of analyzed by individual species.

Impact AQUA-205: Effects of Construction of Restoration Measures on Non-Covered Aquatic Species of Primary Management Concern

NEPA Effects: Refer to Impact AQUA-7 under delta smelt for a discussion of the effects of construction of restoration measures on non-covered species of primary management concern because effects would be avoided by limiting the frequency, duration, and spatial extent of in-water work and implementing the commitments described in detail under Impact AQUA-1 and in Appendix 3B, *Environmental Commitments*. The potential effects of the construction of restoration measures under Alternative 4A would be similar to those described for Alternative 1A (see Alternative 1A, Impact AQUA-7). For a detailed discussion, please see Alternative 1A, Impact AQUA-7. The effects would not be adverse.

CEQA Conclusion: As described immediately above, the impacts of the construction of restoration measures would be less than significant and no mitigation would be required.

Impact AQUA-206: Effects of Contaminants Associated with Restoration Measures on Non-Covered Aquatic Species of Primary Management Concern

NEPA Effects: Refer to Impact AQUA-8 under delta smelt for a discussion of the effects of contaminants associated with restoration measures on non-covered species of primary management concern. The potential effects of contaminants associated with restoration measures under Alternative 4A would be similar to those described for Alternative 1A (see Alternative 1A, Impact AQUA-8), although would be greatly reduced in extent. For a detailed discussion, please see Alternative 1A, Impact AQUA-8. The effects would not be adverse.

CEQA Conclusion: As described immediately above, the impacts of the contaminants associated with restoration measures would be less than significant and no mitigation would be required.

Impact AQUA-207: Effects of Restored Habitat Conditions on Non-Covered Aquatic Species of Primary Management Concern

NEPA Effects: Refer to Impact AQUA-9 under delta smelt for a general discussion of the effects of restored habitat conditions on non-covered species of primary management concern. Although there are minor differences, the effects are similar because restoration would provide new habitat areas for those species that occur in the areas that are restored. The effect of restoration activities under Alternative 4A relative to NAA_ELT would not be adverse.

CEQA Conclusion: The impacts of restored habitat conditions would range from slightly beneficial to beneficial, depending on where the restoration occurs and how it is designed. No mitigation would be required.

Other Environmental Commitments (Environmental Commitment 12, Environmental Commitment 15, and Environmental Commitment 16)

The effects of other Environmental Commitments under Alternative 4A would be similar for all non-covered species; therefore, the analysis below is combined for all non-covered species instead of analyzed by individual species.

Impact AQUA-208: Effects of Methylmercury Management on Non-Covered Aquatic Species of Primary Management Concern (Environmental Commitment 12)

NEPA Effects: Refer to Impact AQUA-10 under delta smelt for a discussion of the effects of methylmercury management on non-covered species of primary management concern. The potential effects of methylmercury management under Alternative 4A would be similar to those described for Alternative 1A (see Alternative 1A, Impact AQUA-10). For a detailed discussion, please see Alternative 1A, Impact AQUA-10. The effects would not be adverse because it is expected to reduce overall methylmercury levels resulting from habitat restoration.

CEQA Conclusion: As described immediately above, the impacts of methylmercury management would be less than significant and no mitigation would be required.

Impact AQUA-211: Effects of Localized Reduction of Predatory Fish on Non-Covered Aquatic Species of Primary Management Concern (Environmental Commitment 15)

NEPA Effects: Refer to Alternative 1A, Impact AQUA-13 under delta smelt for a discussion of the effects of predatory fish (striped bass and largemouth bass) and predator management on non-predatory fish. The purpose of predatory fish management is to reduce predation pressure at predation hotspots and not to reduce the overall populations of these species. This management will have localized negative effects on predatory fish; under Alternative 4A, the efforts will be focused solely at the south Delta export facilities and the proposed north Delta intakes. Given that the numbers of predatory fish are high and the extent of the habitats in which they occur is extensive, the effects of Environmental Commitment 15 will not be adverse.

CEQA Conclusion: Refer to Alternative 1A, Impact AQUA-13 under delta smelt for a discussion of the effects of predatory fish and predator management on non-predatory fish. The purpose of predatory fish management is to reduce predation pressure at predation hotspots and not to reduce the overall populations of these species. This management will have localized negative effects on predatory fish; under Alternative 4A, the efforts will be focused solely at the south Delta export facilities and the proposed north Delta intakes. Given that the numbers of predatory fish are high and the extent of the habitats in which they occur is extensive, the effects of Environmental Commitment 15 will be less than significant. No mitigation is necessary.

Impact AQUA-212: Effects of Nonphysical Fish Barriers on Non-Covered Aquatic Species of Primary Management Concern (Environmental Commitment 16)

NEPA Effects: As described for Alternative 1A, nonphysical barriers (NPBs) are designed to alter juvenile salmon migration routes using sound, light, and bubbles and are not intended for other species. Alternative 4A proposes only one location for a NPB, at the divergence of Georgiana Slough from the Sacramento River. The in-water structures associated with this barriers may attract fish predators (including the non-covered aquatic species striped bass and largemouth bass), increasing localized predation risk for smaller individuals of the noncovered aquatic species migrating past the barriers, but the extent of this effect is highly uncertain. The general potential effects of nonphysical fish barriers under Alternative 4A would be similar to those described for Alternative 1A (see Alternative 1A, Impact AQUA-14). For a detailed discussion, please see Alternative 1A, Impact AQUA-14. Whereas striped bass, American shad, threadfin shad, and largemouth bass could encounter the proposed barrier, Sacramento-San Joaquin roach and hardhead are unlikely to be present in the vicinity of the nonphysical barrier, and California bay shrimp do not occur in these habitats so there would be no effect. The effects on non-covered aquatic species of primary management concern would not be adverse.

CEQA Conclusion: As described immediately above, the impacts of a nonphysical fish barrier would be less than significant and no mitigation would be required.

Upstream Reservoirs

Impact AQUA-217: Effects of Water Operations on Reservoir Coldwater Fish Habitat

NEPA Effects: As discussed in Alternative 1A, Impact AQUA-217 and reported in Table 11-1A-102, this effect would not be adverse because coldwater fish habitat in the CVP and SWP upstream reservoirs under Alternative 4A would not be substantially reduced when compared to the No Action Alternative. Carryover storage thresholds for all CVP and SWP reservoirs would be similar between the No Action Alternative and Alternative 4A.

CEQA Conclusion: As discussed in Alternative 1A, Impact AQUA-217 and reported in Table 11-1A-102, Alternative 4A would reduce the quantity of coldwater fish habitat in the CVP and SWP relative to Existing Conditions. There would be There would be 5 and 7 fewer years (7% and 9% lower, respectively) that exceed the 250 TAF carryover storage threshold in Folsom Reservoir under H3_ELT and H4_ELT, respectively, relative to Existing Conditions, which could result in a significant impact.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of results between the alternative and NAA is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA and informed by the NEPA analysis above, there would be negligible effects on mean monthly reservoir storage. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in reservoir storage under Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.