

1 Steelhead

2 Construction and Maintenance of Water Conveyance Facilities

3 The discussion of potential effects to delta smelt from construction and maintenance of the water
4 conveyance facilities under Alternative 4A is also relevant to steelhead. Adult and juvenile steelhead
5 would have the potential to overlap construction and maintenance to a minor degree (Table 11-8).

6 Impact AQUA-91: Effects of Construction of Water Conveyance Facilities on Steelhead

7 The potential effects of construction of the water conveyance facilities on steelhead would be the
8 same as described for Alternative 4 (Impact AQUA-91). This section provides additional detail on
9 underwater noise impacts which are also applicable to Impact AQUA-91 in Alternative 4.

10 Table 11-8 presents the life stages of CCV steelhead and the months of their potential presence in
11 the north, east, and south Delta during the proposed in-water construction period (June 1–October
12 31). Steelhead eggs and fry would not be exposed to underwater noise from pile driving activities
13 because the proposed construction activities are located in areas that are downstream from the
14 principal spawning and early rearing areas.

15 Under Alternative 4A, adult steelhead could be exposed to pile driving sound during their
16 migrations past the construction sites of the proposed intakes, barge unloading facilities, and Head
17 of Old River. Based on historical migration timing, migrating adults may be present in the Delta and
18 lower Sacramento and San Joaquin Rivers during their upstream migration from August through
19 November and during their downstream migration as kelts (post-spawn adults) from February
20 through May (Hallock 1961, Busby et al. 1996). Juvenile steelhead emigrate episodically from natal
21 streams during fall, winter, and spring high flows, with peaks in abundance in the spring (March
22 through June) and fall (October through November) (McEwan 2001, Nobriga and Cadrett 2001).

23 Similar to Chinook salmon, the risk of injury or mortality of adult steelhead from pile driving noise is
24 low because of their large size, high mobility, and rapid migration rates through the Delta and lower
25 rivers. The risk of exposure to harmful levels of underwater noise and/or delays in migration is
26 further reduced by the intermittent nature of pile driving activities, the daily cessation of pile
27 driving at night, and the implementation of vibratory driving or other no-impact pile driving
28 methods whenever feasible. Based on the general timing of steelhead outmigration through the
29 Delta, exposure of juvenile steelhead to pile driving noise will be substantially minimized by the
30 restriction of in-water pile driving period to June 1 through October 31. Most steelhead potentially
31 encountering pile driving noise are large, yearling and older smolts (> 10 grams) that are expected
32 to migrate rapidly through the Delta based on recent telemetry studies using tagged hatchery
33 juveniles (DeLaney et al. 2014). As discussed for Chinook salmon, the restriction of pile driving to
34 daylight hours would also reduce the exposure of juvenile steelhead to pile driving noise because of
35 the general tendency for salmonids to migrate at night. However, pile driving noise could have
36 indirect effects on survival by disrupting feeding, resting, and sheltering behavior of individuals that
37 are within the range of noise levels associated with behavioral effects.

38 Based on the foregoing analysis, the potential exists for some injury and mortality of juvenile
39 steelhead from pile driving noise but only a small proportion of the population is at risk based on
40 the low degree of overlap of pile driving activities with outmigration timing, and the relatively large
41 size and mobility of juveniles that may encounter pile driving noise (migrating smolts).
42 Implementation of Mitigation Measures AQUA-1a and AQUA-1b will further reduce this risk.

1 *NEPA Effects:* As concluded for Alternative 4, Impact AQUA-91, the effect would not be adverse for
2 steelhead. Implementation of the measures described in Appendix 3B, *Environmental Commitments*,
3 such as *Environmental Training; Stormwater Pollution Prevention Plan; Erosion and Sediment Control*
4 *Plan; Hazardous Materials Management Plan; Spill Prevention, Containment, and Countermeasure*
5 *Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material; Fish Rescue and Salvage*
6 *Plan; and Barge Operations Plan* would guide rapid and effective response in the case of inadvertent
7 **spills of hazardous materials. This species' natural tolerance to turbidity, would likely avoid the risk**
8 of any adverse turbidity effects resulting from project construction. Construction would not be
9 expected to increase predation rates relative to baseline conditions. Construction will result in both
10 temporary and permanent alteration of rearing and migratory habitats used by steelhead. However,
11 Alternative 4A includes Environmental Commitment 4 to restore tidal habitat and Environmental
12 Commitment 6 to restore channel margin habitat. The direct effects of underwater construction
13 noise on steelhead that may be present could be adverse if steelhead are exposed. However,
14 implementation of Mitigation Measures AQUA-1a and AQUA-1b, combined with the in-water work
15 window that would minimize exposure, would reduce the potential for effects from underwater
16 noise and this effect would not be adverse.

17 *CEQA Conclusion:* As described in Alternative 4, Impact AQUA-91, the impact of the construction of
18 water conveyance facilities on steelhead would not be significant except for construction noise
19 associated with pile driving. Construction of Alternative 4A involves several elements with the
20 potential to affect steelhead. However, these turbidity and hazardous material spill effects will be
21 effectively avoided and/or minimized through implementation of environmental commitments (see
22 Impact AQUA-1 and Appendix 3B, *Environmental Commitments: Environmental Training; Stormwater*
23 *Pollution Prevention Plan; Erosion and Sediment Control Plan; Hazardous Materials Management*
24 *Plan; Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel*
25 *Material, and Dredged Material; Fish Rescue and Salvage Plan; and Barge Operations Plan*).
26 Implementation of Mitigation Measures AQUA-1a and AQUA-1b would reduce that noise impact to
27 less than significant.

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

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

33 Impact AQUA-92: Effects of Maintenance of Water Conveyance Facilities on Steelhead

34 *NEPA Effects:* Once constructed, Alternative 4A structures and facilities will require ongoing
35 periodic maintenance that includes in-water work activities with the potential to affect steelhead.
36 These activities include periodic cleaning and replacement of screens, trash racks, and associated
37 machinery and dredging to maintain intake capacity. These activities will produce disturbance and
38 underwater noise, and may generate turbidity or other water quality effects. In general, the
39 likelihood of adverse effects on steelhead from maintenance activities would be avoided and
40 minimized through the same methods and rationale described for Impact AQUA-1. The potential
41 effects of the maintenance of water conveyance facilities under Alternative 4A would be the same as
42 those described for Alternative 4, Impact AQUA-92. As concluded in Impact AQUA-92, the impact
43 would not be adverse for steelhead.

1 *CEQA Conclusion:* As described in Alternative 4, Impact AQUA-92, the impact of the maintenance of
2 water conveyance facilities on steelhead would be less than significant and no mitigation is required.
3 Once constructed, Alternative 4A structures and facilities will require ongoing periodic maintenance
4 that includes in-water work activities with the potential to affect steelhead. These activities include
5 periodic cleaning and replacement of screens, trash racks, and associated machinery and dredging
6 to maintain intake capacity. These activities will produce disturbance and underwater noise, and
7 may generate turbidity or other water quality effects. In general, the likelihood of adverse effects on
8 steelhead from maintenance activities would be avoided and minimized through the same methods
9 and rationale described for Impact AQUA-1.

10 Operations of Water Conveyance Facilities

11 Impact AQUA-93: Effects of Water Operations on Entrainment of Steelhead

12 *Water Exports from SWP/CVP South Delta Facilities*

13 Under Alternative 4A, entrainment loss at the south Delta export facilities, as estimated by the
14 salvage density method, would be reduced by about 52% (~4,800 fish; Table 11-4A-77) across all
15 years compared to NAA_ELT. Losses under Scenario H3_ELT would be greatest in below normal
16 (~7,300 fish) and lowest in wet water years (~2,100 fish). Conditions under Scenario H4_ELT would
17 further reduce entrainment loss at the south Delta facilities due to decreased exports.

18 Table 11-4A-77. Juvenile Steelhead Annual Entrainment Index at the SWP and CVP Salvage
19 Facilities—Differences between Model Scenarios for Alternative 4A (Scenario H3_ELT)

| Water Year Type | Absolute Difference (Percent Difference) | |
|-----------------|--|--------------------|
| | EXISTING CONDITIONS vs. H3_ELT | NAA_ELT vs. H3_ELT |
| Wet | -4,143 (-66%) | -4,443 (-68%) |
| Above Normal | -7,358 (-57%) | -7,752 (-58%) |
| Below Normal | -4,529 (-38%) | -4,674 (-39%) |
| Dry | -1,750 (-23%) | -1,517 (-21%) |
| Critical | -1,007 (-17%) | -917 (-16%) |
| All Years | -4,620 (-51%) | -4,810 (-52%) |

Shading indicates 10% or greater increased entrainment.

Note: Estimated annual number of fish lost, based on non-normalized data.

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

20

21 *Water Exports from SWP/CVP North Delta Intake Facilities*

22 The impact would be similar in type to Alternative 1A, Impact AQUA-93, but the degree would be
23 less because Alternative 4A would have fewer intakes, therefore, under Alternative 4A there would
24 be about a 40% reduction in impingement and predation risk relative to Alternative 1A.

25 *Predation Associated with Entrainment*

26 Entrainment-related predation loss at the south Delta facilities would be no greater and may be
27 lower than baseline (NAA_ELT), due to a reduction in entrainment. Conditions under Scenario
28 H4_ELT would further reduce entrainment-related predation loss compared to Scenario H3_ELT.

1 Predation at the north Delta would be increased due to the construction of the proposed SWP/CVP
2 water export facilities on the Sacramento River. It is assumed that per capita steelhead predation
3 losses would be similar to those predicted for spring-run Chinook salmon, although slightly reduced
4 because of the larger size of steelhead outmigrants. Bioenergetics modeling with a median predator
5 density of 0.12 predators per foot (0.39 predators per meter) of intake predicts a predation loss of
6 about 0.2% of the juvenile spring-run juvenile population (Table 11-4A-30).

7 *NEPA Effects:* In conclusion, operations under Alternative 4A under both flow scenarios (H3_ELT
8 and H4_ELT) would reduce entrainment at the south Delta facilities and minimize or avoid
9 entrainment with screens at the north Delta intakes. Predation loss at the south Delta would be
10 reduced and predation at the north Delta intakes would likely have a very minor impact on the
11 overall steelhead population. The overall effect under Alternative 4A would not be adverse.

12 *CEQA Conclusion:* As described above, entrainment losses of juvenile steelhead would decrease
13 under Alternative 4A (H3_ELT) compared to Existing Conditions at the south Delta export facilities
14 (Table 11-4A-77). The screened intakes of the north Delta diversion, as designed, would exclude
15 juvenile salmonids. The impact of predation associated with entrainment would be the same as
16 described above as predation loss at the south Delta (no greater and possibly lower compared with
17 Existing Conditions), but increased slightly at the north Delta intakes. There may be a minor
18 increase in predation loss under Alternative 4A associated with the north Delta intakes, but this is
19 uncertain and the population-level effect would likely be small. Entrainment loss under Scenario
20 H4_ELT is expected to be less compared to Scenario H3_ELT. Overall, the impact would be less than
21 significant and no mitigation is required.

22 Impact AQUA-94: Effects of Water Operations on Spawning and Egg Incubation Habitat for 23 Steelhead

24 In general, Alternative 4A would have negligible effects on spawning and egg incubation habitat for
25 steelhead relative to the NAA_ELT.

26 H3_ELT/ESO_ELT

27 *Sacramento River*

28 The primary steelhead spawning and egg incubation period extends from January through April.
29 Results of the CALSIM analyses of instream flows within the reach where the majority of steelhead
30 spawning occurs (Keswick Dam to upstream of RBDD) were summarized by month and water-year
31 type based on estimated flows at Keswick and upstream of RBDD (Appendix 11C, *CALSIM II Model
32 Results utilized in the Fish Analysis*). Lower flows can reduce the instream area available for
33 spawning and egg incubation, and rapid reductions in flow can expose redds leading to mortality.
34 Mean flows under H3_ELT would generally be similar to those under NAA_ELT,. Overall results
35 indicate negligible project-related effects on flow.

36 SacEFT predicts that there would be no effects between NAA_ELT and H3_ELT in spawning metrics
37 including percentage of years with good spawning availability, measured as weighted usable area,
38 redd scour risk, percentage of years with good (lower) egg incubation conditions, and redd
39 dewatering risk (Table 11-4A-78). Results indicate negligible project-related effects on steelhead
40 habitat metrics related to spawning and egg incubation in the Sacramento River.

1 Mean water temperatures in the Sacramento River at Keswick and Red Bluff were examined during
2 the January through April primary steelhead spawning and egg incubation period (Appendix 11D,
3 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
4 *Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT
5 and H3_ELT in any month or water year type throughout the period at either location. Based on
6 negligible effects on mean flow, SacEFT metrics related to spawning and egg incubation, and water
7 temperature conditions compared to NAA_ELT, project-related effects of H3_ELT on flow would not
8 affect steelhead spawning conditions in the Sacramento River.

9 **Table 11-4A-78. Difference and Percent Difference in Percentage of Years with “Good” Conditions**
10 **for Steelhead Habitat Metrics in the Upper Sacramento River (from SacEFT)**

| Metric | EXISTING CONDITIONS vs. H3_ELT | NAA_ELT vs. H3_ELT |
|-------------------------|--------------------------------|--------------------|
| Spawning WUA | 0 (0%) | 0 (0%) |
| Redd Scour Risk | -3 (-4%) | 0 (0%) |
| Egg Incubation | 0 (0%) | 0 (0%) |
| Redd Dewatering Risk | -1 (-2%) | 0 (0%) |
| Juvenile Rearing WUA | 1 (2%) | -3 (-7%) |
| Juvenile Stranding Risk | -9 (-26%) | -4 (-14%) |

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

WUA = Weighted Usable Area.

11

12 *Clear Creek*

13 The primary spawning and egg incubation period for Clear Creek is January through April. Results of
14 the CALSIM analyses of instream flows for the Clear Creek were summarized by month and water-
15 year type for January through April (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
16 *Analysis*). Lower flows can reduce the instream area available for spawning and egg incubation, and
17 rapid reductions in flow can expose redds leading to mortality.

18 Mean flows in Clear Creek during January through April under H3_ELT would be similar to those
19 under NAA_ELT. Therefore, H3_ELT would have negligible effects on mean flows in Clear Creek for
20 the primary steelhead spawning and egg incubation period of January to April.

21 Redd dewatering risk was evaluated for Clear Creek based on flow reductions for each month during
22 the incubation period (January through April); results are summarized in Table 11-4A-79. The
23 greatest monthly reduction in flows under H3_ELT would be no different than that under NAA_ELT.

24 No water temperature modeling was conducted in Clear Creek.

25 Based on mean monthly flows and flow reductions, there would be no effects of H3_ELT on
26 steelhead spawning and egg incubation habitat conditions.

1 Table 11-4A-79. Comparisons of Greatest Monthly Reduction (Percent Change) in Instream Flow
2 under Model Scenarios in Clear Creek during the January–April Steelhead Spawning and Egg
3 Incubation Period^a

| Water Year Type | EXISTING CONDITIONS vs. H3_ELT | NAA_ELT vs. H3_ELT |
|-----------------|--------------------------------|--------------------|
| Wet | -25 (-38%) | 0 (0%) |
| Above Normal | 0 (NA) | 0 (NA) |
| Below Normal | 0 (NA) | 0 (NA) |
| Dry | 0 (NA) | 0 (NA) |
| Critical | 0 (NA) | 0 (NA) |

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

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

^a Redd dewatering risk not applicable for months when flows during the egg incubation period were at or greater than flows in the month when spawning is assumed to occur. A negative value indicates that the greatest monthly reduction would be of greater magnitude (worse) under the alternative than under the baseline.

4

5 *Feather River*

6 Steelhead spawning and egg incubation on the Feather River occurs primarily in Hatchery Ditch and
7 the low-flow channel in the general vicinity of the Feather River Hatchery. Effects of H3_ELT on flow
8 during the spawning and egg incubation period (January through April) in the Feather River were
9 evaluated using the results of CALSIM analyses of instream flows within the reach where the
10 majority of steelhead spawning occurs (low-flow channel) based on estimated flows above
11 Thermalito Afterbay (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Although
12 recent surveys have found that very few steelhead (0 to 28%) spawn in the high-flow channel, (J.
13 Kindopp pers. comm.), flows were also evaluated in the high-flow channel based on information in
14 the Feather River at Thermalito Afterbay (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
15 *Analysis*). Lower flows can reduce the instream area available for spawning and egg incubation, and
16 rapid reductions in flow can expose redds leading to mortality.

17 Mean flows in the Feather River high-flow channel during January through April under H3_ELT
18 would generally be similar to flows under NAA_ELT, except for occasional increases (up to 30%
19 higher) and decreases (up to 17% lower) that, due to their low magnitude and frequency, would not
20 amount to a biologically meaningful effect to steelhead.

21 Instream flows affect physical habitat quality and availability through changes in wetted channel
22 width, water depth, and water velocities. Results of IFIM studies (WUA versus flow relationships)
23 provide information on the spawning habitat conditions in the low-flow channel. Results of CALSIM
24 modeling show that instream flows in the Feather River low-flow channel were the same for
25 NAA_ELT and H3_ELT regardless of month and water year type and range from 700 to 800 cfs under
26 all conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Therefore,
27 H3_ELT is not expected to affect physical habitat conditions for steelhead spawning and egg
28 incubation within the Feather River low-flow channel.

29 Water temperatures in the low-flow channel of the Feather River are determined largely by cold
30 water pool storage in Oroville Reservoir and instream flow releases. Because instream flows in the
31 low-flow channel would be the same under H3_ELT and NAA_ELT, any simulated changes in water

1 temperatures under H3_ELT would be attributed to changes in reservoir storage. Reservoir storage
2 in May and September provides an indicator of cold water pool availability. Mean May Oroville
3 storage volume under H3_ELT would be similar to storage under NAA_ELT in all water year types
4 (Table 11-4A-45). September Oroville storage volume under H3_ELT would be similar to volume in
5 wet, above normal, and below normal water years and 12% to 15% greater than volume under
6 NAA_ELT during dry and critical water years (Table 11-4A-39).

7 Effects of H3_ELT on water temperature-related spawning and egg incubation conditions for
8 steelhead in the Feather River were analyzed by comparing the percent of months between January
9 through April over the 82-year CALSIM modeling period that exceed a 56°F temperature threshold
10 in the low-flow channel (above Thermalito Afterbay) (Table 11-4A-80). Differences in the percent of
11 months exceeding the threshold between NAA_ELT and H3_ELT would be negligible (<5% on an
12 absolute scale).

13 Table 11-4A-80. Differences between Baseline and H3_ELT Scenarios in Percent of Months during
14 the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River
15 above Thermalito Afterbay Exceed the 56°F Threshold, January through April

| Month | Degrees Above Threshold | | | | |
|--------------------------------|-------------------------|-----------|--------|--------|--------|
| | >1.0 | >2.0 | >3.0 | >4.0 | >5.0 |
| EXISTING CONDITIONS vs. H3_ELT | | | | | |
| January | 0 (NA) | 0 (NA) | 0 (NA) | 0 (NA) | 0 (NA) |
| February | 0 (NA) | 0 (NA) | 0 (NA) | 0 (NA) | 0 (NA) |
| March | 0 (0%) | 1 (NA) | 1 (NA) | 1 (NA) | 0 (NA) |
| April | 12 (143%) | 5 (100%) | 4 (NA) | 1 (NA) | 0 (NA) |
| NAA_ELT vs. H3_ELT | | | | | |
| January | 0 (NA) | 0 (NA) | 0 (NA) | 0 (NA) | 0 (NA) |
| February | 0 (NA) | 0 (NA) | 0 (NA) | 0 (NA) | 0 (NA) |
| March | -1 (-50%) | 1 (NA) | 1 (NA) | 1 (NA) | 0 (NA) |
| April | 1 (6%) | -1 (-11%) | 0 (0%) | 0 (0%) | 0 (NA) |

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

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

16

17 The effects of H3_ELT on water temperature-related spawning and egg incubation conditions for
18 steelhead in the Feather River were also analyzed by comparing the total degree-months for months
19 that exceed the 56°F NMFS threshold during the January through April steelhead spawning period
20 for all 82 years (Table 11-4A-81). There would be no difference (<5% on an absolute scale) in total
21 degree-months exceeded between NAA_ELT and H3_ELT for any month or water year type.

1 Table 11-4A-81. Differences between Baseline and H3_ELT Scenarios in Total Degree-Months
 2 (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 56°F in
 3 the Feather River above Thermalito Afterbay, January through April

| Month | Water Year Type | EXISTING CONDITIONS vs. H3_ELT | NAA_ELT vs. H3_ELT |
|----------|-----------------|--------------------------------|--------------------|
| January | 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) |
| February | 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) |
| March | Wet | 0 (NA) | 0 (NA) |
| | Above Normal | 0 (NA) | 0 (NA) |
| | Below Normal | 0 (NA) | 0 (NA) |
| | Dry | 0 (NA) | 0 (NA) |
| | Critical | 3 (300%) | 2 (100%) |
| | All | 3 (300%) | 2 (100%) |
| April | Wet | 0 (NA) | 0 (NA) |
| | Above Normal | 2 (100%) | 1 (33%) |
| | Below Normal | 3 (75%) | 0 (0%) |
| | Dry | 6 (120%) | -1 (-8%) |
| | Critical | 7 (NA) | 0 (0%) |
| | All | 18 (164%) | 0 (0%) |

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

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

4
 5 Overall for the Feather River, these similarity of flows and water temperature results indicate that
 6 H3_ELT would not affect flow and water temperatures conditions for steelhead spawning in the
 7 Feather River.

8 *American River*

9 The primary steelhead spawning and egg incubation period for the American River extends from
 10 January through April. Results of the CALSIM analyses of instream flows within the lower American
 11 River at the confluence with the Sacramento River were summarized by month and water-year type
 12 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Lower flows can reduce the
 13 instream area available for spawning and egg incubation and rapid reductions in flow can dewater
 14 redds leading to mortality. Mean flows under H3_ELT would be similar to flows under NAA_ELT
 15 during all months and water year types, with few exceptions.

1 Mean water temperatures in the American River at the Watt Avenue Bridge were evaluated during
2 the January through April steelhead spawning and egg incubation period (Appendix 11D,
3 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
4 *Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between
5 NAA_ELT and H3_ELT in any month or water year type throughout the period.

6 The percent of months exceeding the 56°F temperature threshold in the American River at the Watt
7 Avenue Bridge was evaluated during November through April (Table 11-4A-64). Steelhead spawn
8 and eggs incubate in the American River between January and April. During this period, the percent
9 of months exceeding the threshold under H3_ELT would similar to (absolute difference) the percent
10 under NAA_ELT.

11 Total degree-months exceeding 56°F were summed by month and water year type at the Watt
12 Avenue Bridge during November through April (Table 11-4A-65). During the January through April
13 steelhead spawning and egg incubation period, total degree-months would be similar between
14 NAA_ELT and H3_ELT.

15 Based on mean monthly flows and water temperature effects, effects under H3_ELT in the American
16 River would consist primarily of negligible effects (<5%) on mean monthly flows and water
17 temperatures and would not have biologically meaningful effects on steelhead spawning and egg
18 incubation conditions in the American River.

19 *Stanislaus River*

20 Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the
21 January through April steelhead spawning and egg incubation period (Appendix 11C, *CALSIM II*
22 *Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT throughout this period would
23 be nearly identical to flows under NAA_ELT.

24 Water temperatures throughout the Stanislaus River would be the same under NAA_ELT and
25 H3_ELT throughout the January through April steelhead spawning and egg incubation period
26 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
27 *utilized in the Fish Analysis*).

28 *San Joaquin River*

29 The mainstem San Joaquin River does not provide habitat for steelhead spawning or egg incubation.

30 *Mokelumne River*

31 Flows in the Mokelumne River at the Delta were examined during the January through April
32 steelhead spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the*
33 *Fish Analysis*). Flows under H3_ELT throughout this period would be the same as flows under
34 NAA_ELT.

35 Water temperature modeling was not conducted in the Mokelumne River.

1 H4_ELT/HOS_ELT

2 *Sacramento River*

3 Flows in the Sacramento River at Keswick and upstream of Red Bluff during January through April
4 under H4_ELT would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model*
5 *Results utilized in the Fish Analysis*). Mean water temperatures in the Sacramento River at Keswick
6 and Red Bluff were examined during the January through April primary steelhead spawning and egg
7 incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation*
8 *Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in
9 mean water temperature between NAA_ELT and H4_ELT in any month or water year type
10 throughout the period at either location. Based on negligible effects on mean flow and water
11 temperature conditions compared to NAA_ELT, project-related effects of H4_ELT on flow would not
12 affect steelhead spawning conditions in the Sacramento River.

13 *Clear Creek*

14 Mean flows in the Clear Creek during January through April under H4_ELT would generally be
15 similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).
16 No water temperature modeling was conducted in Clear Creek.

17 *Feather River*

18 Flows in the Feather River above Thermalito Afterbay (low-flow channel) during January through
19 April under H4_ELT would be the same as flows under NAA_ELT (Appendix 11C, *CALSIM II Model*
20 *Results utilized in the Fish Analysis*). Mean flows in the Feather River below Thermalito Afterbay
21 (high-flow channel) during January through April under H4_ELT would generally be similar to or up
22 to 548% greater than flows under NAA_ELT, with mean flow in April for all water year types
23 combined 87% greater under H4_ELT.

24 Mean September Oroville storage under H4_ELT would be similar to storage under NAA_ELT in wet,
25 above normal, and below normal water years, and would be 28% and 44% greater for dry and
26 critical years, respectively (Table 11-4A-39). May Oroville storage would be 11% to 16 lower under
27 H4_ELT than under NAA_ELT in wet, above normal, and below normal water years, would be 24%
28 greater in critical years, and would be similar in dry years (Table 11-4A-45).

29 Differences in the percent of months exceeding the 56°F threshold in the Feather River at Gridley
30 between NAA_ELT and H4_ELT would generally be negligible (<5% on an absolute scale) during
31 January through March (Table 11-4A-69). The percent of months exceeding the threshold under
32 H4_ELT during April would be up to 20% lower (absolute difference) than the percent under
33 NAA_ELT. This represents a small benefit of H4_ELT to steelhead spawning habitat conditions in the
34 Feather River.

35 Differences in the percent of months exceeding the 56°F threshold in the Feather River above
36 Thermalito Afterbay between NAA_ELT and H4_ELT would be negligible during January through
37 March (Table 11-4A-82). During April, the percent of months exceeding the threshold under H4_ELT
38 would be similar to or up to 6% lower (absolute difference) than the percent under NAA_ELT. This
39 represents a small benefit of H4_ELT to steelhead spawning habitat conditions in the Feather River.

1 Table 11-4A-82. Differences between Baselines and H4_ELT Scenarios in Percent of Months during
 2 the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River
 3 above Thermalito Afterbay Exceed the 56°F Threshold, January through April

| Month | Degrees Above Threshold | | | | |
|--------------------------------|-------------------------|-----------|-----------|--------|--------|
| | >1.0 | >2.0 | >3.0 | >4.0 | >5.0 |
| EXISTING CONDITIONS vs. H4_ELT | | | | | |
| January | 0 (NA) | 0 (NA) | 0 (NA) | 0 (NA) | 0 (NA) |
| February | 0 (NA) | 0 (NA) | 0 (NA) | 0 (NA) | 0 (NA) |
| March | 0 (0%) | 1 (NA) | 0 (NA) | 0 (NA) | 0 (NA) |
| April | 7 (86%) | 0 (0%) | 1 (NA) | 1 (NA) | 0 (NA) |
| NAA_ELT vs. H4_ELT | | | | | |
| January | 0 (NA) | 0 (NA) | 0 (NA) | 0 (NA) | 0 (NA) |
| February | 0 (NA) | 0 (NA) | 0 (NA) | 0 (NA) | 0 (NA) |
| March | -1 (-50%) | 1 (NA) | 0 (NA) | 0 (NA) | 0 (NA) |
| April | -4 (-19%) | -6 (-56%) | -2 (-67%) | 0 (0%) | 0 (NA) |

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).
 NA = could not be calculated because the denominator was 0.

4
 5 Total degree-months (all water year types combined) above the 56°F threshold in the Feather River
 6 at Gridley under H4_ELT would be the same as those under NAA_ELT during January and February
 7 (Table 11-4A-70). During March and April, degree-months under H4_ELT would be 4% and 41%
 8 lower, respectively. The reductions in degree-months during March under H4_ELT would be too
 9 small and infrequent to have a biologically meaningful effect on steelhead spawning habitat
 10 conditions in the Feather River, although the reductions during April would represent a moderate
 11 benefit to steelhead. Total degree-months above the 56°F threshold in the Feather River above
 12 Thermalito Afterbay under H4_ELT would be similar to those under NAA_ELT during January
 13 through April (Table 11-4A-83).

1 Table 11-4A-83. Differences between Baselines and H4_ELT Scenarios in Total Degree-Months (°F-
2 Months) by Month and Water Year Type for Water Temperature Exceedances above 56°F in the
3 Feather River at above Thermalito Afterbay, January through April

| Month | Water Year Type | EXISTING CONDITIONS vs. H4_ELT | NAA_ELT vs. H4_ELT |
|----------|-----------------|--------------------------------|--------------------|
| January | 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) |
| February | 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) |
| March | Wet | 0 (NA) | 0 (NA) |
| | Above Normal | 0 (NA) | 0 (NA) |
| | Below Normal | 0 (NA) | 0 (NA) |
| | Dry | 0 (NA) | 0 (NA) |
| | Critical | 2 (200%) | 1 (50%) |
| | All | 2 (200%) | 1 (50%) |
| April | Wet | 0 (NA) | 0 (NA) |
| | Above Normal | 1 (50%) | 0 (0%) |
| | Below Normal | 0 (0%) | -3 (-43%) |
| | Dry | 7 (140%) | 0 (0%) |
| | Critical | 8 (NA) | 1 (14%) |
| | All | 15 (136%) | -3 (-10%) |

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

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

4

5 *American River*

6 Mean flows in the American River at the confluence with the Sacramento River during January
7 through April under H4_ELT would generally be similar to flows under NAA_ELT (Appendix 11C,
8 *CALSIM II Model Results utilized in the Fish Analysis*).

9 Mean water temperatures in the American River at the Watt Avenue Bridge were evaluated during
10 the January through April steelhead spawning and egg incubation period (Appendix 11D,
11 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
12 *Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT
13 and H4_ELT in any month or water year type throughout the period. The percent of months
14 exceeding the 56°F temperature threshold in the American River at the Watt Avenue Bridge was
15 evaluated during November through April (Table 11-4A-71). Steelhead spawn and eggs incubate in

1 the American River between January and April. During January through April period, the percent of
2 months exceeding the threshold under H4_ELT would be similar to or up to 9% lower (absolute
3 difference) than the percent under NAA_ELT.

4 Total degree-months exceeding 56°F were summed by month and water year type at the Watt
5 Avenue Bridge during November through April (Table 11-4A-72). During the January through April
6 steelhead spawning and egg incubation period, total degree-months would be similar between
7 NAA_ELT and H4_ELT.

8 *Stanislaus River*

9 Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the
10 January through April steelhead spawning and egg incubation period (Appendix 11C, *CALSIM II*
11 *Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT throughout this period would
12 be about the same as those under NAA_ELT.

13 Water temperatures throughout the Stanislaus River would be similar under NAA_ELT and H4_ELT
14 throughout the January through April steelhead spawning and egg incubation period (Appendix
15 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in*
16 *the Fish Analysis*).

17 *San Joaquin River*

18 The mainstem San Joaquin River does not provide habitat for steelhead spawning or egg incubation.

19 *Mokelumne River*

20 Flows in the Mokelumne River at the Delta were examined during the January through April
21 steelhead spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the*
22 *Fish Analysis*). Mean flows under H4_ELT throughout this period would be identical to flows under
23 NAA_ELT.

24 Water temperature modeling was not conducted in the Mokelumne River.

25 *NEPA Effects:* Collectively, these modeling results indicate that the effects of Alternative 4A on flow
26 would not be adverse because they would not substantially reduce suitable spawning habitat or
27 substantially reduce the number of fish as a result of egg development. There would be negligible
28 effects on Alternative 4A on mean monthly flows, water temperatures, and reservoir storage in all
29 rivers analyzed. Further, the SacEFT model predicts that there would be no effects to spawning and
30 egg incubation habitat in the Sacramento River.

31 *CEQA Conclusion:* In general, Alternative 4A would degrade the quantity and quality of spawning
32 and egg incubation habitat for steelhead relative to Existing Conditions. However, as further
33 **described below in the Summary of CEQA Conclusion, reviewing the alternative's impacts in relation**
34 **to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea**
35 **level rise, climate change, and future water demand. Informed by the NAA_ELT comparison,**
36 **Alternative 4A would not affect the quantity and quality of spawning and egg incubation habitat for**
37 **steelhead relative to the CEQA conclusion.**

1 H3_ELT /ESO_ELT

2 *Sacramento River*

3 The primary steelhead spawning and egg incubation period extends from January through April.
4 Results of the CALSIM analyses of instream flows within the reach where the majority of steelhead
5 spawning occurs (Keswick Dam to upstream of RBDD) were summarized by month and water-year
6 type based on estimated flows at RBDD (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
7 *Analysis*). Lower flows can reduce the instream area available for spawning and egg incubation, and
8 rapid reductions in flow can expose redds leading to mortality. Mean flows under H3_ELT would
9 generally be similar to those under Existing Conditions, except for February, in which flows would
10 be up to 14% higher, depending on the water year type.

11 SacEFT predicts little or no change in spawning habitat, egg incubation, redd dewatering risk, and
12 redd scour risk for H3_ELT compared to Existing Conditions (Table 11-4A-78).

13 Mean water temperatures in the Sacramento River at Keswick and Red Bluff were examined during
14 the January through April primary steelhead spawning and egg incubation period (Appendix 11D,
15 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
16 *Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing
17 Conditions and H3_ELT in any month or water year type throughout the period at either location.
18 Based on negligible effects on mean flow, SacEFT metrics related to spawning and egg incubation,
19 and water temperature conditions compared to Existing Conditions, project-related effects of
20 H3_ELT on flow would not affect steelhead spawning conditions in the Sacramento River.

21 *Clear Creek*

22 The primary spawning and egg incubation period for Clear Creek is January through April. Results of
23 the CALSIM analyses of instream flows for the Clear Creek were summarized by month and water-
24 year type for January through April (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
25 *Analysis*). Lower flows can reduce the instream area available for spawning and egg incubation, and
26 rapid reductions in flow can expose redds leading to mortality.

27 Mean flows under H3_ELT would be similar to or greater than flows under Existing Conditions for all
28 months, including 40% greater flow for January of wet years and 10% greater flow for all four
29 months in critical water years. Increases in flow would have a beneficial effect on spawning
30 conditions.

31 Redd dewatering risk was evaluated for Clear Creek based on flow reductions for each month during
32 the incubation period (January through April); results are summarized in Table 11-4A-79. The
33 greatest monthly reduction in flows under H3_ELT would be similar to that under Existing
34 Conditions, except for a 25% increase (absolute difference) in the greatest monthly flow reduction
35 in wet years under H3_ELT.

36 No water temperature modeling was conducted in Clear Creek.

37 Based on mean flows and increased maximum flow reductions only in wet years, there would be no
38 effects of H3_ELT on steelhead spawning and egg incubation habitat conditions.

1 *Feather River*

2 Effects of H3_ELT on flow during the spawning and egg incubation period (January through April) in
3 the Feather River were evaluated using the results of CALSIM analyses of instream flows within the
4 reach where the majority of steelhead spawning occurs (low-flow channel) based on estimated
5 flows above Thermalito Afterbay (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
6 *Analysis*). Flows in the high-flow channel were characterized based on information in the Feather
7 River at Thermalito Afterbay (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).
8 Lower flows can reduce the instream area available for spawning and egg incubation, and rapid
9 reductions in flow can expose redds leading to mortality.

10 Results of CALSIM modeling show that instream flows in the Feather River low-flow channel were
11 the same for Existing Conditions and H3_ELT regardless of month and water year type and range
12 from 700 to 800 cfs under all conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
13 *Analysis*). Therefore, H3_ELT is not expected to affect physical habitat conditions for steelhead
14 spawning and egg incubation within the Feather River low-flow channel.

15 Mean flows in the Feather River high-flow channel during under H3_ELT would generally be similar
16 to or up to 48% lower than flows under Existing Conditions in January through March, with minor
17 exceptions, and would be similar to or up to 29% greater in April. The reductions in flow would
18 adversely affect spawning and egg incubation habitat.

19 Mean May Oroville storage volume under H3_ELT would generally be similar to storage under
20 Existing Conditions in wet and above normal water year types and 5% to 12% lower in below
21 normal, dry, and critical water year types (Table 11-4A-42). Mean September Oroville storage
22 volume under H3_ELT would be 5% to 29% lower than volume under Existing Conditions in wet,
23 above normal, below normal, and dry water years and would be similar in critical water years
24 (Table 11-4A-33).

25 Mean water temperatures in the Feather River low-flow channel (above Thermalito Afterbay) and
26 high-flow channel (below Thermalito Afterbay) were examined during the January through April
27 steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality*
28 *Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). At both locations,
29 there would be no differences (<5%) in mean water temperatures between H3_ELT and Existing
30 Conditions for all months and water year types throughout the period.

31 Effects of H3_ELT on water temperature-related spawning and egg incubation conditions for
32 steelhead in the Feather River were analyzed by comparing the percent of months between January
33 through April over the 82-year CALSIM modeling period that exceed a 56°F temperature threshold
34 in the low-flow channel (above Thermalito Afterbay) (Table 11-4A-80). Differences in the percent of
35 months exceeding the threshold between Existing Conditions and H3_ELT would be negligible (<5%
36 on an absolute scale), except for a 12% increase (absolute difference) for the >1.0°F above the
37 threshold in April.

38 The effects of H3_ELT on water temperature-related spawning and egg incubation conditions for
39 steelhead in the Feather River were also analyzed by comparing the total degree-months for months
40 that exceed the 56°F NMFS threshold in the low-flow channel (above Thermalito Afterbay) during
41 the January through April steelhead spawning period for all 82 years (Table 11-4A-81). There would
42 be no difference (<5% on an absolute scale) for January through March in total degree-months

1 exceeded between Existing Conditions and H3_ELT for any water year type, and an 18 degree-month
2 increase (164% higher on a relative scale) in April for all water year types combined.

3 Overall, the effects of H3_ELT on flows in the Feather River below Thermalito Afterbay would
4 include substantial decreases in mean flow during some months and water year types. There would
5 be minor increases in the exceedance of water temperature thresholds in the low-flow channel
6 during April, coupled with reductions in coldwater pool availability in the Oroville Reservoir,
7 especially in September.

8 *American River*

9 The primary steelhead spawning and egg incubation period for the American River extends from
10 January through April. Results of the CALSIM analyses of instream flows within the lower American
11 River at the confluence with the Sacramento River were summarized by month and water-year type
12 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Lower flows can reduce the
13 instream area available for spawning and egg incubation and rapid reductions in flow can dewater
14 redds leading to mortality. Combining water year types, mean flows under H3_ELT would be higher
15 than those under Existing Conditions during January and February and would be similar during
16 March and April.

17 Mean water temperatures in the American River at the Watt Avenue Bridge were evaluated during
18 the January through April steelhead spawning and egg incubation period (Appendix 11D,
19 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
20 *Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between
21 Existing Conditions and H3_ELT in any month or water year type throughout the period.

22 The percent of months exceeding the 56°F temperature threshold in the American River at the Watt
23 Avenue Bridge was evaluated during November through April (Table 11-4A-64). Steelhead spawn
24 and eggs incubate in the American River between January and April. During January and February,
25 the percent of month exceeding the threshold under Existing Conditions and H3 would be similar.
26 During March and April, the percent of months exceeding the threshold under H3 would be up to
27 17% greater (absolute difference) than the percent under Existing Conditions.

28 Total degree-months (all water year types combined) exceeding 56°F were summed by month and
29 water year type at the Watt Avenue Bridge during November through April (Table 11-4A-65).
30 During January and February, there would be no difference in total degree-months above the
31 threshold between Existing Conditions and H3_ELT. During March and April, total degree-months
32 under H3_ELT would be 16 and 80 degree-months greater, respectively, than under Existing
33 Conditions.

34 The effect of H3_ELT on mean flow and water temperature in the American River would be
35 negligible although increased exceedances of the 56°F temperature threshold indicate a negative
36 effect to steelhead spawning and egg incubation conditions.

37 *Stanislaus River*

38 Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the
39 January through April steelhead spawning and egg incubation period (Appendix 11C, *CALSIM II*
40 *Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT throughout this period would
41 generally be similar to or up to 29% lower than flows under Existing Conditions.

1 Water temperatures throughout the Stanislaus River would be the same under Existing Conditions
2 and H3_ELT throughout the January through April steelhead spawning and egg incubation period
3 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
4 *utilized in the Fish Analysis*).

5 *San Joaquin River*

6 The mainstem San Joaquin River does not provide habitat for steelhead spawning or egg incubation.

7 *Mokelumne River*

8 Flows in the Mokelumne River at the Delta were examined during the January through April
9 steelhead spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the*
10 *Fish Analysis*). Mean flows under H3_ELT throughout this period would be similar to flows under
11 Existing Conditions, with minor exceptions.

12 Water temperature modeling was not conducted in the Mokelumne River.

13 H4_ELT/HOS_ELT

14 *Sacramento River*

15 Mean flows in the Sacramento River at Keswick and upstream of Red Bluff during January through
16 April under H4_ELT would generally be similar to flows under Existing Conditions, with minor
17 exceptions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

18 Mean water temperatures in the Sacramento River at Keswick and Red Bluff were examined during
19 the January through April primary steelhead spawning and egg incubation period (Appendix 11D,
20 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
21 *Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing
22 Conditions and H4_ELT in any month or water year type throughout the period at either location.

23 *Clear Creek*

24 Mean flows in the Clear Creek during January through April under H4_ELT would generally be
25 similar to or up to 40% greater than flows under Existing Conditions (Appendix 11C, *CALSIM II*
26 *Model Results utilized in the Fish Analysis*). No water temperature modeling was conducted in Clear
27 Creek.

28 *Feather River*

29 Flows in the Feather River above Thermalito Afterbay (low-flow channel) during January through
30 April under H4_ELT would be identical to flows under Existing Conditions (Appendix 11C, *CALSIM II*
31 *Model Results utilized in the Fish Analysis*). Mean flows in the Feather River below Thermalito
32 Afterbay (high-flow channel) under H4_ELT would be up to 36% lower than flows under Existing
33 Conditions during January and February, similar during March, and up to 509% greater during April.

34 May Oroville storage under H4_ELT would be up to 19% lower than storage under Existing
35 Conditions in all water year types except critical water years, in which storage would be 15%
36 greater under H4_ELT (Table 11-4A-45). September Oroville storage under H4_ELT would be about
37 24% lower than storage under Existing Conditions in wet, above normal, and below normal water
38 years, similar in dry years, and 32% higher in critical years (Table 11-4A-39).

1 Mean water temperatures in the Feather River low-flow channel (upstream of Thermalito Afterbay)
2 and high-flow channel (at Thermalito Afterbay) were examined during the January through April
3 steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality*
4 *Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no
5 differences (<5%) in mean water temperatures between H4_ELT and Existing Conditions for all
6 months and water year types at either location throughout the period.

7 Differences in the percent of months exceeding the 56°F threshold between Existing Conditions and
8 H4_ELT would generally be negligible (<5% on an absolute scale) during January through April,
9 except for the >1.0 degree category for April, in which the percent of months exceeding the
10 threshold would be 7% higher (absolute difference) (Table 11-4A-82).

11 Total degree-months (all water years combined) above the 56°F threshold under H4_ELT would be
12 similar to those under Existing Conditions during January and February, and would be 19 and 80
13 degree-days higher for March and April, respectively (Table 11-4A-83). These increases, although
14 large when expressed as percentages, constitute a small proportion with respect to the 82-year
15 period of analysis.

16 *American River*

17 Mean flows in the American River at the confluence with the Sacramento River during January
18 through April under H4_ELT would generally be similar to flows under Existing Conditions, with a
19 number of minor exceptions especially in February (Appendix 11C, *CALSIM II Model Results utilized*
20 *in the Fish Analysis*).

21 Mean water temperatures in the American River at the Watt Avenue Bridge were evaluated during
22 the January through April steelhead spawning and egg incubation period (Appendix 11D,
23 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
24 *Fish Analysis*). There would be no differences (<5%) in mean water temperatures between H4_ELT
25 and Existing Conditions for all months and water year types throughout the period.

26 The percent of months exceeding the 56°F temperature threshold in the American River at the Watt
27 Avenue Bridge was evaluated during November through April (Table 11-4A-71). Steelhead spawn
28 and eggs incubate in the American River between January and April. During January and February,
29 there would be no differences in the percent of month exceeding the threshold between Existing
30 Conditions and H4_ELT. During March and April, the percent of months exceeding the threshold
31 under H4_ELT would be up to 11% greater (absolute difference) than the percent under Existing
32 Conditions.

33 Total degree-months exceeding 56°F were summed by month and water year type at the Watt
34 Avenue Bridge during November through April (Table 11-4A-72). During the January and February,
35 there would be no difference in total degree-months above the threshold between Existing
36 Conditions and H4_ELT. During March and April, total degree-months for all water year types
37 combined under H4_ELT would be 19 and 80 degree-months, respectively, greater than under
38 Existing Conditions.

39 *Stanislaus River*

40 Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the
41 January through April steelhead spawning and egg incubation period (Appendix 11C, *CALSIM II*
42 *Model Results utilized in the Fish Analysis*). Mean Flows under H4_ELT would be lower than those

1 under Existing Conditions for about half of the water year means within the four month period, with
2 up to 29% lower flows under in February of critical water years.

3 Water temperatures in the Stanislaus River at the confluence with the San Joaquin River was
4 evaluated during the January through April steelhead spawning and egg incubation period
5 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
6 *utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperatures
7 between H4_ELT and Existing Conditions for all months and water year types throughout the period.

8 *San Joaquin River*

9 The mainstem San Joaquin River does not provide habitat for steelhead spawning or egg incubation.

10 *Mokelumne River*

11 Flows in the Mokelumne River at the Delta were examined during the January through April
12 steelhead spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the*
13 *Fish Analysis*). Mean flows under H4_ELT would generally be similar to flows under Existing
14 Conditions, with minor exceptions.

15 Water temperature modeling was not conducted in the Mokelumne River.

16 Summary of CEQA Conclusion

17 Under Alternative 4A, there are flow and cold water pool availability reductions in the Feather,
18 American, and Stanislaus Rivers, as well as temperature increases in the Feather and American
19 rivers that would lead to biologically meaningful increases in egg mortality and overall reduced
20 habitat conditions for spawning steelhead and egg incubation, as compared to Existing Conditions.
21 Alternative 4A would not have significant effects on steelhead spawning conditions in the
22 Sacramento River, Clear Creek, San Joaquin River, or the Mokelumne River. Contrary to the NEPA
23 conclusion set forth above, these modeling results indicate that the difference between Existing
24 Conditions and Alternative 4A could be significant because the alternative could substantially
25 reduce suitable spawning habitat and substantially reduce the number of steelhead as a result of egg
26 mortality.

27 However, this interpretation of the biological modeling results is likely attributable to different
28 modeling assumptions for four factors: sea level rise, climate change, future water demands, and
29 implementation of the alternative. As discussed in Section 11.3.3, because of differences between the
30 CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to
31 vary between one another under the same impact discussion. The baseline for the CEQA analysis is
32 Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA
33 baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT
34 implementation period), including the projected effects of climate change (precipitation patterns),
35 sea level rise and future water demands, as well as implementation of required actions under the
36 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not
37 partition the effects of implementation of the alternative from the effects of sea level rise, climate
38 change, and future water demands, the comparison to Existing Conditions may not offer a clear
39 understanding of the impact of the alternative on the environment. This suggests that the
40 comparison of results between the alternative and NAA_ELT is a better approach because it isolates
41 the effect of the alternative from those of sea level rise, climate change, and future water demands.

1 When compared to NAA_ELT and informed by the NEPA analysis above, there would be negligible
2 effects on mean monthly flows, water temperatures, and reservoir storage. Further, the SacEFT
3 model predicts that there would be no effects to spawning and egg incubation habitat in the
4 Sacramento River. These modeling results represent the increment of change attributable to the
5 alternative, demonstrating the similarities in flows, reservoir storage, and water temperature under
6 Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing
7 Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

8 Impact AQUA-95: Effects of Water Operations on Rearing Habitat for Steelhead

9 In general, the effects of Alternative 4A on steelhead rearing conditions would be negligible relative
10 to the NAA_ELT.

11 H3_ELT/ESO_ELT

12 *Sacramento River*

13 Juvenile steelhead rear within the Sacramento River and its tributaries throughout the year because
14 juveniles inhabit upstream areas for a period of 1 to 2 years before migrating downstream to the
15 ocean. Results of the CALSIM analyses of instream flows within the reach where the majority of
16 steelhead spawning occurs (Keswick Dam to upstream of Red Bluff) (Appendix 11C, *CALSIM II Model
17 Results utilized in the Fish Analysis*) were evaluated for effects of H3_ELT. Lower flows can reduce the
18 instream area available for rearing and rapid reductions in flow can strand fry and juveniles, leading
19 to mortality.

20 In general, mean flows under H3_ELT would be similar to flows under NAA_ELT throughout the
21 year, except during November when the mean flows under H3_ELT would be up to 23% lower at
22 Keswick and up to 18% lower at Red Bluff. These small and isolated reductions would not have
23 biologically meaningful effects on steelhead fry and juvenile rearing habitat.

24 Mean water temperatures in the Sacramento River at Keswick and Bend Bridge were examined
25 during the year-round steelhead juvenile rearing period (Appendix 11D, *Sacramento River Water
26 Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would
27 be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any month or
28 water year type throughout the period at either location.

29 SacEFT predicts that there would be a 7% reduction in years classified as good juvenile rearing
30 habitat conditions under H3_ELT compared to NAA_ELT, and a 14% reduction in the percentage of
31 years classified “good” with respect to juvenile stranding risk (Table 11-4A-78). On an absolute
32 scale, these changes to rearing WUA and stranding risk would be 3% and 4%, respectively, which
33 would be negligible to juvenile steelhead.

34 Based on mean monthly flows, SacEFT rearing metrics, and water temperature effects, project-
35 related effects under Alternative 4A in the Sacramento River would not have biologically meaningful
36 negative effects on steelhead rearing conditions. Effects of H3_ELT consist primarily of negligible
37 effects that would not have biologically meaningful effects on rearing success.

38 *Clear Creek*

39 Steelhead rear in Clear Creek throughout the year. Lower flows can reduce the instream area
40 available for rearing and rapid reductions in flow can strand fry and juveniles leading to mortality.

1 Instream flows estimated from the modeling each month and water-year type were used to compare
2 among model scenarios (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). In
3 general, flows under H3_ELT would be similar to those under NAA_ELT, with minor exceptions.

4 Evaluation of the minimum instream flows in Clear Creek indicates that H3_ELT would have no
5 effect (0%) on minimum instream flows in any water year type, except for a decrease (-50 cfs or -
6 100%) for dry water years (Table 11-4A-84).

7 Table 11-4A-84. Minimum Monthly Instream Flow (cfs) for Model Scenarios in Clear Creek during
8 the Year-Round Juvenile Steelhead Rearing Period

| Water Year Type | EXISTING CONDITIONS vs. H3_ELT | NAA_ELT vs. H3_ELT |
|-----------------|--------------------------------|--------------------|
| Wet | 0 (0%) | 0 (0%) |
| Above Normal | 0 (0%) | 0 (0%) |
| Below Normal | -70 (-100%) | 0 (NA) |
| Dry | -50 (-100%) | -50 (-100%) |
| Critical | -50 (-100%) | 0 (NA) |

Note: Minimum flows occurred between October and March.

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

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

9

10 Denton (1986) developed flow recommendations for steelhead in Clear Creek using IFIM (Figure 11-
11 1A-4). The current Clear Creek management regime uses flows slightly lower than those
12 recommended by Denton. Results from a new IFIM study on Clear Creek are currently being
13 analyzed. Depending on results of this study the flow regime could be adjusted in the future. It is
14 expected that the modeled flows will be suitable for the existing steelhead populations in Clear
15 Creek. No change in effect on steelhead in Clear Creek is anticipated.

16 No water temperature modeling was conducted in Clear Creek.

17 These results indicate that effects of H3_ELT on flows would not affect juvenile steelhead rearing
18 habitats in Clear Creek.

19 *Feather River*

20 The low-flow channel is the primary reach of the Feather River utilized by steelhead for spawning
21 and rearing. Although there is relatively little natural steelhead production in the river, most
22 steelhead spawning and rearing appears to occur in the low-flow channel in habitats associated with
23 well-vegetated side channels (Cavallo et al. 2003; California Department of Water Resources
24 unpublished data). Because these habitats are relatively uncommon they could limit natural
25 steelhead production. Lower flows can reduce the instream area available for rearing and rapid
26 reductions in flow can strand fry and juveniles leading to mortality.

27 There would be no change in flows for H3_ELT relative to NAA_ELT in the low-flow channel. Flow in
28 the low-flow channel is projected to remain between 700 and 800 cfs except during occasional flood
29 control releases. This flow is less than pre-dam levels during all months of the year as a result of
30 water diversions through the Thermalito Afterbay. The significance of these flow conditions for
31 steelhead spawning and rearing is uncertain. Feather River screw trap data indicate that Chinook

1 salmon initiate emigration regardless of flow regime (i.e., they do not wait for a high-flow pulse).
2 This is likely true for steelhead as well.

3 Mean May storage at Oroville under H3_ELT would be similar to that under NAA_ELT for all water
4 year types (Table 11-4A-45). September Oroville storage under H3_ELT would be similar to or up to
5 15% greater than storage under NAA_ELT (Table 11-4A-39).

6 The river channel downstream of Thermalito (high-flow channel) offers few of the habitat types
7 upon which steelhead appear to rely in the low-flow channel. Experiments and fish observations
8 also indicate that predation risk for juvenile steelhead is higher downstream of the Thermalito
9 outlet (California Department of Water Resources 2004). Increased predation risk is likely a
10 function of water temperature, where warm water nonnative species such as striped bass,
11 largemouth bass, and smallmouth bass are more prevalent, and in general, predators have greater
12 metabolic requirements. Thus, summer temperatures that exceed 65°F and the absence of preferred
13 steelhead habitat currently appear to limit steelhead rearing in the river downstream of the
14 Thermalito outlet. Comparisons of CALSIM data by month and water year type (Appendix 11C,
15 *CALSIM II Model Results utilized in the Fish Analysis*) indicate that mean flows under H3_ELT would
16 generally be similar to or greater than (up to 106% greater for June of below normal water years)
17 those under NAA_ELT in the high-flow channel in all months except July through September. During
18 July through September, flows under H3_ELT would be up to 48% lower than those under NAA_ELT
19 depending on month and water-year type.

20 Mean monthly water temperatures in the Feather River in both above (low-flow channel) and at
21 Thermalito Afterbay (high-flow channel) were examined during the year-round steelhead juvenile
22 rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature*
23 *Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly
24 water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the
25 period at either location.

26 Effects of H3_ELT on water temperature-related juvenile rearing conditions for steelhead in the
27 Feather River were analyzed by comparing the percent of months between May through August
28 over the 82-year CALSIM modeling period that exceed a 63°F temperature threshold in the low-flow
29 channel (above Thermalito Afterbay) and by comparing the percent of months between October and
30 April that exceed a 56°F threshold at Gridley. Results for the low-flow channel (above Thermalito
31 Afterbay) and Gridley are presented for spring-run rearing and fall-run spawning and egg
32 incubation in Impacts AQUA-59 and AQUA-76, respectively. In the low-flow channel and at Gridley,
33 there would generally be only minor differences between NAA_ELT and H3_ELT in the percent of
34 months exceeding the threshold, except in the low-flow channel in June, for which there would be up
35 to a 9% reduction (absolute difference) in the percent of months under H3_ELT.

36 The effects of H3_ELT on water temperature-related juvenile rearing conditions for steelhead in the
37 Feather River were also analyzed by comparing the total degree-months for months that exceed the
38 63°F NMFS threshold during May through August in the low-flow channel and the 56°F threshold
39 during October through April at Gridley. Results for the low-flow channel (above Thermalito
40 Afterbay) and Gridley are presented for spring-run rearing and fall-run spawning and egg
41 incubation in Impacts AQUA-59 and AQUA-76, respectively. In the low flow channel and at Gridley,
42 there would be small increases and decreases in exceedances above the thresholds, but overall no
43 biologically meaningful effects.

1 *American River*

2 Flows in the American River at the confluence with the Sacramento River were examined for the
3 year-round steelhead rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
4 *Analysis*). Mean flows under H3_ELT would generally be similar to or up to 25% greater than flows
5 under NAA_ELT in all months except August, September, and November. Flows during these months
6 would be up to 25% lower under H3_ELT than under NAA_ELT. Because these reductions would
7 occur only during these months and would be generally low to moderate, they are not expected to
8 cause biologically meaningful effects on steelhead juvenile rearing habitat.

9 Mean water temperatures in the American River at the confluence with the Sacramento River and
10 the Watt Avenue Bridge were examined during the year-round steelhead rearing period (Appendix
11 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in*
12 *the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature
13 between NAA_ELT and H3_ELT in any month or water year type throughout the period.

14 The percent of months exceeding a 65°F temperature threshold in the American River at the Watt
15 Avenue Bridge was evaluated during May through October (Table 11-4A-85). During May through
16 July, and October, the percent of months exceeding the threshold under H3_ELT would be similar to
17 or up to 9% lower (absolute difference) than the percent under NAA_ELT. During August and
18 September, the percent of months exceeding the threshold would increase up to 11% (absolute
19 difference) under H3_ELT.

20 Table 11-4A-85. Differences between Baseline and H3_ELT Scenarios in Percent of Months during
21 the 82-Year CALSIM Modeling Period during Which Water Temperatures in the American River at
22 the Watt Avenue Bridge Exceed the 65°F Threshold, May through October

| Month | Degrees Above Threshold | | | | |
|--------------------------------|-------------------------|-----------|-----------|-----------|-----------|
| | >1.0 | >2.0 | >3.0 | >4.0 | >5.0 |
| EXISTING CONDITIONS vs. H3_ELT | | | | | |
| May | 26 (131%) | 20 (133%) | 11 (100%) | 6 (100%) | 4 (75%) |
| June | 27 (42%) | 22 (42%) | 17 (42%) | 15 (48%) | 14 (65%) |
| July | 0 (0%) | 1 (1%) | 30 (47%) | 21 (59%) | 25 (143%) |
| August | 0 (0%) | 2 (3%) | 17 (21%) | 49 (103%) | 57 (184%) |
| September | 11 (13%) | 37 (70%) | 32 (100%) | 30 (185%) | 22 (300%) |
| October | 17 (350%) | 10 (400%) | 9 (NA) | 2 (NA) | 1 (NA) |
| NAA_ELT vs. H3_ELT | | | | | |
| May | -1 (-3%) | -2 (-7%) | -1 (-5%) | 0 (0%) | 0 (0%) |
| June | 0 (0%) | -2 (-3%) | -5 (-8%) | -7 (-14%) | -9 (-20%) |
| July | 0 (0%) | 0 (0%) | -2 (-3%) | -9 (-13%) | -5 (-11%) |
| August | 0 (0%) | 0 (0%) | 0 (0%) | 5 (5%) | 11 (15%) |
| September | 2 (3%) | 9 (11%) | 6 (11%) | 7 (19%) | 4 (14%) |
| October | -1 (-5%) | -1 (-9%) | 2 (40%) | 1 (100%) | 1 (NA) |

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

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

1 Total degree-months exceeding 65°F were summed by month and water year type at the Watt
2 Avenue Bridge during May through October (Table 11-4A-86). Total degree-months (all water year
3 types combined) exceeding the threshold would be similar between NAA_ELT and H3_ELT or up to
4 38 degree-months lower under H3_ELT in all months except August and September, in which
5 degree-months would be 28 degree-months higher under H3_ELT.

6 Table 11-4A-86. Differences between Baseline and H3_ELT Scenarios in Total Degree-Months
7 (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 65°F in
8 the American River at the Watt Avenue Bridge, May through October

| Month | Water Year Type | EXISTING CONDITIONS vs. H3_ELT | NAA_ELT vs. H3_ELT |
|-----------|-----------------|--------------------------------|--------------------|
| May | Wet | 9 (150%) | 0 (0%) |
| | Above Normal | 7 (NA) | -2 (-22%) |
| | Below Normal | 7 (233%) | -2 (-17%) |
| | Dry | 22 (100%) | 1 (2%) |
| | Critical | 13 (68%) | -1 (-3%) |
| | All | 58 (116%) | -4 (-4%) |
| June | Wet | 31 (182%) | -7 (-13%) |
| | Above Normal | 12 (50%) | -8 (-18%) |
| | Below Normal | 21 (72%) | -7 (-12%) |
| | Dry | 10 (15%) | -17 (-18%) |
| | Critical | 33 (66%) | 1 (1%) |
| | All | 107 (57%) | -38 (-13%) |
| July | Wet | 32 (41%) | -16 (-13%) |
| | Above Normal | 9 (33%) | 1 (3%) |
| | Below Normal | 12 (35%) | -4 (-8%) |
| | Dry | 35 (56%) | 7 (8%) |
| | Critical | 30 (37%) | 4 (4%) |
| | All | 118 (42%) | -8 (-2%) |
| August | Wet | 69 (87%) | 7 (5%) |
| | Above Normal | 19 (46%) | 2 (3%) |
| | Below Normal | 29 (52%) | 2 (2%) |
| | Dry | 63 (93%) | 15 (13%) |
| | Critical | 40 (51%) | 2 (2%) |
| | All | 220 (68%) | 28 (5%) |
| September | Wet | 35 (146%) | 12 (26%) |
| | Above Normal | 14 (88%) | 4 (15%) |
| | Below Normal | 26 (93%) | 7 (15%) |
| | Dry | 35 (83%) | 5 (7%) |
| | Critical | 25 (51%) | 0 (0%) |
| | All | 135 (85%) | 28 (11%) |
| October | Wet | 6 (600%) | 1 (17%) |
| | Above Normal | 5 (NA) | 0 (0%) |
| | Below Normal | 3 (NA) | 1 (50%) |
| | Dry | 9 (NA) | 0 (0%) |
| | Critical | 9 (180%) | 0 (0%) |
| | All | 32 (533%) | 2 (6%) |

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

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

9

1 These results indicate that effects of H3_ELT on flow and water temperatures would not reduce
2 juvenile rearing conditions in the American River.

3 *Stanislaus River*

4 Flows in the Stanislaus River at the confluence with the San Joaquin River were examined for the
5 year-round steelhead rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
6 *Analysis*). Mean flows under H3_ELT would be similar to flows under NAA_ELT throughout the
7 period.

8 Mean water temperatures throughout the Stanislaus River would be similar under NAA_ELT and
9 H3_ELT throughout the year-round period (Appendix 11D, *Sacramento River Water Quality Model*
10 *and Reclamation Temperature Model Results utilized in the Fish Analysis*).

11 *San Joaquin River*

12 Flows in the San Joaquin River at Vernalis were examined for the year-round steelhead rearing
13 period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under
14 H3_ELT would be similar to flows under NAA_ELT throughout the period.

15 Water temperature modeling was not conducted in the San Joaquin River.

16 *Mokelumne River*

17 Flows in the Mokelumne River at the Delta were examined for the year-round steelhead rearing
18 period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under
19 H3_ELT would be the same as flows under NAA_ELT throughout the period.

20 Water temperature modeling was not conducted in the Mokelumne River.

21 H4_ELT /HOS_ELT

22 *Sacramento River*

23 Mean flows in the Sacramento River at Keswick and upstream of Red Bluff under H4_ELT would
24 generally be similar to flows under NAA_ELT year-round, except during November (11% to 20%
25 lower) at Keswick (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). These small
26 and isolated reductions would not have biologically meaningful effects on steelhead fry and juvenile
27 rearing habitat.

28 Mean monthly water temperatures in the Sacramento River at Keswick and Bend Bridge were
29 examined during the year-round steelhead juvenile rearing period (Appendix 11D, *Sacramento River*
30 *Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There
31 would be no differences (<5%) in mean monthly water temperature between NAA_ELT and H4_ELT
32 in any month or water year type throughout the period at either location.

33 *Clear Creek*

34 Year-round flows in the Clear Creek under H4_ELT would generally be similar to flows under
35 NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). No water
36 temperature modeling was conducted in Clear Creek.

1 *Feather River*

2 Year-round flows in the Feather River above Thermalito Afterbay (low-flow channel) under H4_ELT
3 would be the same as flows under H3_ELT (Appendix 11C, *CALSIM II Model Results utilized in the*
4 *Fish Analysis*). Mean flows in the Feather River below Thermalito Afterbay (high-flow channel)
5 under H4_ELT would be similar to or up to 548% higher than (April of below normal water years)
6 flows under NAA_ELT during October through June. During July through September, mean flows
7 would be lower for every water year type (up to 60% lower for September of below normal years),
8 except for critical years during August and September, in which flows under H4_ELT would be 48%
9 and 52% higher.

10 Mean water temperatures in the Feather River in both above (low-flow channel) and at Thermalito
11 Afterbay (high-flow channel) were examined during the year-round steelhead juvenile rearing
12 period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model*
13 *Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water
14 temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period
15 at either location.

16 The analysis evaluating the percent of months exceeding water temperature thresholds from NMFS
17 presented in Impacts AQUA-59 and AQUA-76 indicates that there would be small to moderate
18 benefits (i.e., reduced percent of months exceeding the threshold) of H4_ELT relative to NAA_ELT in
19 the low-flow channel and at Gridley.

20 The analysis evaluating the total degree-months exceeding water temperature thresholds from
21 NMFS (63°F for the low flow channel and 56°F at Gridley) presented in Impacts AQUA-59 and
22 AQUA-76 indicates that exceedances under H4_ELT would generally be similar to or lower than
23 those under NAA_ELT in the low flow channel and at Gridley during spring and early summer
24 months, but higher during fall months.

25 Mean May storage would be 11% to 16% lower under H4_ELT relative to NAA_ELT in wet, above
26 normal, and below normal water years, similar in dry years, and 24% higher in critical years (Table
27 11-4A-45). September Oroville storage under H4_ELT would be similar to or up to 44% greater than
28 storage under NAA_ELT (Table 11-4A-39).

29 *American River*

30 Year-round flows in the American River at the confluence with the Sacramento River under H4_ELT
31 would generally be similar to flows under NAA_ELT, except during August and September, for which
32 mean flows would be up to 33% lower under H4_ELT depending on water year type, and October,
33 for which flows would be up to 24% higher (Appendix 11C, *CALSIM II Model Results utilized in the*
34 *Fish Analysis*).

35 Mean monthly water temperatures in the American River at the confluence with the Sacramento
36 River and the Watt Avenue Bridge were examined during the year-round steelhead rearing period
37 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
38 *utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water
39 temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

40 The percent of months exceeding a 65°F temperature threshold in the American River at the Watt
41 Avenue Bridge was evaluated during May through October (Table 11-4A-87). The percent of months

1 exceeding the threshold under H4_ELT would be similar to or up to 20% lower (absolute difference)
2 than the percent under NAA_ELT for all months.

3 Total degree-months exceeding 65°F were summed by month and water year type at the Watt
4 Avenue Bridge during May through October (Table 11-4A-88). Total degree-months exceeding the
5 threshold would be similar between NAA_ELT and H4_ELT throughout the period, except during July
6 and August, in which total degree-months under H4_ELT would be 11% and 24% lower, and during
7 September, in which total degree-months under H4_ELT would be 11% higher.

8 *Stanislaus River*

9 Flows in the Stanislaus River at the confluence with the San Joaquin River were examined for the
10 year-round steelhead rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
11 *Analysis*). Flows under H4_ELT would be similar to flows under NAA_ELT throughout the period.

12 Mean monthly water temperatures throughout the Stanislaus River would be similar under
13 NAA_ELT and H4_ELT throughout the year-round period (Appendix 11D, *Sacramento River Water*
14 *Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

15 *San Joaquin River*

16 Flows in the San Joaquin River at Vernalis were examined for the year-round steelhead rearing
17 period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H4_ELT
18 would be similar to flows under NAA_ELT throughout the period.

19 Water temperature modeling was not conducted in the San Joaquin River.

20 *Mokelumne River*

21 Flows in the Mokelumne River at the Delta were examined for the year-round steelhead rearing
22 period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under
23 H4_ELT would be the same as flows under NAA_ELT throughout the period.

24 Water temperature modeling was not conducted in the Mokelumne River.

25 *NEPA Effects:* Collectively, these modeling results indicate that the effect of Alternative 4A is not
26 adverse because it would not substantially reduce rearing habitat or substantially reduce the
27 number of fish as a result of fry and juvenile mortality. Effects of Alternative 4A on flows and water
28 temperatures would be small and infrequent in the Sacramento River and Clear Creek, and effects in
29 the Feather River and the American River would be more variable, but in general, the overall effects
30 are expected to be slightly beneficial, despite the increased flow variations. Water temperatures in
31 the Sacramento, Feather, American and Stanislaus Rivers would not be affected by Alternative 4A.
32 Overall, Alternative 4A is not expected to have biologically meaningful negative effects on steelhead
33 rearing conditions.

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

1 H3_ELT/ESO_ELT

2 *Sacramento River*

3 Comparisons of CALSIM outputs of mean flow by month and water year type for the Sacramento
4 River at Red Bluff (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) were used to
5 evaluate effects of H3_ELT compared to Existing Conditions. Results for H3_ELT at Keswick were
6 generally similar to those for Existing Conditions, except for September, in which flows were up to
7 34% higher and up to 24% lower, depending on water year type, and October and November, in
8 which flows were up to 20% lower. The results for mean flows at Red Bluff were similar to those for
9 flows at Keswick, except that the differences between H3_ELT and Existing Conditions were
10 generally smaller. The most substantial effects on juvenile rearing habitats would occur from flow
11 reductions in dry and critical water years, including those in September, as well as moderate
12 reductions in dry and or critical years in August, October and November. Based on the overall
13 infrequency and small size of these decreases, and negligible differences or beneficial increases in
14 flow in most of the year, the flow reductions are not expected to have biologically meaningful
15 negative effects on juvenile steelhead rearing conditions in the Sacramento River.

16 Mean water temperatures in the Sacramento River at Keswick and Bend Bridge were examined
17 during the year-round steelhead juvenile rearing period (Appendix 11D, *Sacramento River Water
18 Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). At both
19 locations, mean water temperatures under H3_ELT would generally be similar to those under
20 Existing Conditions, except during July through October at Keswick, when temperatures for critical
21 years would range from 7% to 14% higher under H3_ELT, and for other water year types when
22 temperatures would be up to 8% higher under H3_ELT.

23 SacEFT predicts that there would be a 2% increase in the percentage of years with good juvenile
24 rearing habitat under H3_ELT compared to Existing Conditions (Table 11-4A-78). SacEFT predicts
25 there would be a decrease of 26% in occurrence of years with “good” conditions for juvenile
26 stranding risk (Table 11-4A-78). The increased stranding risk would contribute to the potential for
27 juvenile mortality due to stranding.

28 Based on the incremental effects of reductions in mean monthly flows (up to 24% lower) for several
29 months during drier water year types, including the warmer summer/ fall months of August
30 through November, and increased risk of juvenile stranding (26%), effects of H3_ELT on flows
31 would have biologically meaningful negative effects on juvenile rearing conditions in the
32 Sacramento River.

33 *Clear Creek*

34 Comparisons of mean flows for Clear Creek were used to evaluate effects of H3_ELT relative to
35 Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Lower
36 flows can reduce the instream area available for rearing and rapid reductions in flow can strand fry
37 and juveniles leading to mortality. Effects of H3_ELT year-round would consist primarily of or small
38 changes with respect to Existing Conditions, except that in critical water years during December
39 through April mean flows would increase by 10%, in wet years during January flows would increase
40 40%, and in critical years during September they would fall 19%. The decreases in flow would not
41 be of sufficient frequency and magnitude to cause biologically meaningful negative effects.

42 Evaluation of minimum instream flows for H3_ELT relative to Existing Conditions (Table 11-4A-84)
43 indicates no effect (0%) for wet and above normal, and decreases for the remaining water year

1 types (-50 to -70 cfs or -100%). These reductions corresponds to substantial decreases in total flow
2 during drier water years based on relatively small quantities of flow (e.g., as low as 85 cfs in the
3 summer months in drier water years, and more typically between 150 and 200 in other months).
4 The reductions in minimum instream flows would affect juvenile rearing habitat and could increase
5 stranding risk, particularly in drier water years.

6 No water temperature modeling was conducted in Clear Creek.

7 While effects of H3_ELT on mean monthly flow would consist predominantly of negligible effects,
8 there would be moderate to substantial reductions in minimum instream flows, particularly during
9 drier water years, that would affect juvenile rearing habitat and increase stranding risk in Clear
10 Creek.

11 *Feather River*

12 The low-flow channel is the primary reach of the Feather River utilized by steelhead spawning and
13 rearing. There would be no change in flows for H3_ELT relative to Existing Conditions in the low-
14 flow channel (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

15 Comparisons using CALSIM data by month and water year type for the Feather River at Thermalito
16 (high-flow channel) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) indicate
17 variable effects of H3_ELT relative to Existing Conditions. H3_ELT would cause substantial changes
18 in mean flows for a number of months and water year types. With some exceptions for specific
19 water year types, there would be increases in mean flows of up to 140% during April through June,
20 as well as for wetter years during July through September (up to 192% higher under H3_ELT)).
21 However, for dry and/or critical years during July through September, flows would be up to 52%
22 lower under H3_ELT than under Existing Conditions. H3_ELT would also cause reductions in flow
23 during January through March, especially for below normal water years, of up to 48%, and during
24 many other months and water year types. The flow changes would have a fairly broad range of
25 effects on rearing habitat throughout the year, with reductions occurring in drier water years having
26 the most adverse effects on juvenile rearing conditions.

27 Mean water temperatures in the Feather River in both above (low-flow channel) and at Thermalito
28 Afterbay (high-flow channel) were examined during the year-round steelhead juvenile rearing
29 period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model
30 Results utilized in the Fish Analysis*). In the low-flow channel, mean water temperatures under
31 H3_ELT would be similar (<5%) to those under Existing Conditions for all months and water year
32 types,. In the high-flow channel, mean water temperatures under H3_ELT would be 5% and 6%
33 higher than those under Existing Conditions during July of critical water years and August of dry
34 water years, respectively, and would be similar for the remaining months and water year types.

35 Effects of H3_ELT on water temperature-related juvenile rearing conditions for steelhead in the
36 Feather River were analyzed by comparing the percent of months between May through August
37 over the 82-year CALSIM modeling period that exceed a 63°F temperature threshold in the low-flow
38 channel (above Thermalito Afterbay) and by comparing the percent of months between October and
39 April that exceed a 56°F threshold at Gridley. Results for the low-flow channel (above Thermalito
40 Afterbay) and Gridley are presented for spring-run rearing and fall-run spawning and egg
41 incubation in Impacts AQUA-59 and AQUA-76, respectively. In the low-flow channel and at Gridley,
42 there would be no differences, small increases, and moderate to large increases (absolute

1 difference), in the percent of months exceeding the threshold between H3_ELT and Existing
2 Conditions. This comparison includes the effects of climate change.

3 The effects of H3_ELT on water temperature-related juvenile rearing conditions for steelhead in the
4 Feather River were also analyzed by comparing the total degree-months for months that exceeded the
5 63°F NMFS threshold during May through August in the low-flow channel and the 56°F threshold
6 during October through April at Gridley. Results for the low-flow channel (above Thermalito
7 Afterbay) and Gridley are presented for spring-run rearing and fall-run spawning and egg
8 incubation in Impacts AQUA-59 and AQUA-76, respectively. In the low-flow channel and at Gridley,
9 there would be moderate increases in total degree-months (all water years combined) exceeding the
10 temperature threshold during several months. These comparisons include the effects of climate
11 change.

12 Mean May storage at Oroville would be similar or up to 12% lower under H3_ELT relative to
13 Existing Conditions (Table 11-4A-45). Mean September Oroville storage under H3_ELT would be
14 19% to 29% lower than storage under Existing Conditions for wet, above normal and below normal
15 water years, and would be similar for dry and critical water years (Table 11-4A-39).

16 Overall in the Feather River, effects of H3_ELT on mean flow would consist of substantial increases
17 and decreases for various months and water year types. There would be relatively frequent,
18 substantial flow reductions in drier water years that would affect juvenile rearing habitat conditions
19 and contribute to stranding risk. Further, there would be moderate to large increases in the
20 exceedance of temperature thresholds in the low-flow channel and at Gridley.

21 *American River*

22 CALSIM outputs were used to compare mean flows by month and water year type for H3_ELT for the
23 American River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results*
24 *utilized in the Fish Analysis*). Lower flows can reduce the instream area available for rearing and
25 rapid reductions in flow can strand fry and juveniles leading to mortality. Comparisons of H3_ELT to
26 Existing Conditions indicate highly variable results, with moderately lower or higher flows for many
27 months and water year types. There would be relatively large reductions in flow (up to 52%) for all
28 water year types during August, September, and November, with the largest reductions occurring in
29 the drier water year types. Flows in June would increase 25% in dry water years and would
30 decrease up to 36% in critical and wet water years. The prevalent, substantial reductions inflow,
31 particularly during drier water years, would have biologically meaningful negative effects on
32 juvenile rearing conditions in the American River.

33 Mean water temperatures in the American River at the confluence with the Sacramento River and
34 the Watt Avenue Bridge were examined during the year-round steelhead rearing period (Appendix
35 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in*
36 *the Fish Analysis*). Mean water temperatures under H3_ELT would be 6% to 7% higher than those
37 under Existing Conditions during October of all but critical water years, but would be similar in the
38 remaining months and water year types.

39 The percent of months exceeding a 65°F temperature threshold in the American River at the Watt
40 Avenue Bridge was evaluated during May through October (Table 11-4A-85). The percent of months
41 under H3_ELT would be greater by up to 57% (absolute difference) than those under Existing
42 Conditions during all months examined.

1 Total degree-months exceeding 65°F were summed by month and water year type at the Watt
2 Avenue Bridge during May through October (Table 11-4A-86). Total degree-months exceeding the
3 threshold under H3_ELT would be 32 to 220 degree-months greater than those under Existing
4 Conditions.

5 These results indicate that effects of H3_ELT on flows and water temperatures would affect juvenile
6 steelhead rearing conditions in the American River throughout most of the year, particularly during
7 drier water years.

8 *Stanislaus River*

9 Flows in the Stanislaus River at the confluence with the San Joaquin River were examined for the
10 year-round steelhead rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
11 *Analysis*). Mean flows would generally be similar under H3_ELT relative to Existing Conditions
12 except during February and March, when flows would be up to 29% lower (dry water year type).

13 Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were
14 evaluated during the year-round juvenile steelhead rearing period (Appendix 11D, *Sacramento River*
15 *Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There
16 would be no differences (<5%) in mean water temperatures between H3_ELT and Existing
17 Conditions.

18 *San Joaquin River*

19 Flows in the San Joaquin River at Vernalis were examined for the year-round steelhead rearing
20 period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under
21 H3_ELT would generally be similar to those under Existing Conditions except during June through
22 August, when flows would be up to 23% lower.

23 Water temperature modeling was not conducted in the San Joaquin River.

24 *Mokelumne River*

25 Flows in the Mokelumne River at the Delta were examined for the year-round steelhead rearing
26 period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under
27 H3_ELT would generally be similar to flows under Existing Conditions during January through May
28 and October and November, with exceptions depending on water year type, would be up to 28%
29 greater than flows under Existing Conditions during December, and up to 35% lower than flows
30 under Existing Conditions during June through September.

31 Water temperature modeling was not conducted in the Mokelumne River.

32 H4_ELT/HOS_ELT

33 *Sacramento River*

34 Year-round flows in the Sacramento River at Keswick under H4_ELT would generally be similar to
35 flows under Existing Conditions except during September, when flows would be 28% and 53%
36 higher in wet and above normal water years, respectively, and 20% and 14% lower in dry and
37 critical water years, respectively (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
38 *Analysis*). Flows would also be up to 19% lower in November of dry and critical year types.

39 Differences in mean flows between H4_ELT and Existing conditions at Red Bluff would be similar to

1 but smaller than those at Keswick, except during October, in which mean flow would be up to 16%
2 lower.

3 Mean monthly water temperatures in the Sacramento River at Keswick and Bend Bridge were
4 examined during the year-round steelhead juvenile rearing period (Appendix 11D, *Sacramento River*
5 *Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There
6 would be no differences (<5%) in mean water temperatures between H4_ELT and Existing
7 Conditions for any month or water year types at either location.

8 *Clear Creek*

9 Year-round flows in the Clear Creek under H4_ELT would generally be similar to flows under
10 Existing Conditions, except that in critical water years during December through April mean flows
11 would increase 10%, and in wet years during January flows would increase 40%. (Appendix 11C,
12 *CALSIM II Model Results utilized in the Fish Analysis*). No water temperature modeling was conducted
13 in Clear Creek.

14 *Feather River*

15 Year-round flows in the Feather River above Thermalito Afterbay (low-flow channel) under H4_ELT
16 would be the same as flows under Existing Conditions (Appendix 11C, *CALSIM II Model Results*
17 *utilized in the Fish Analysis*). Mean flows in the Feather River below Thermalito Afterbay (high-flow
18 channel) under H4_ELT would generally be similar to or up to 509% greater than flows under
19 Existing Conditions during April through June, and would generally be lower than flows under
20 Existing Conditions (up to 54% lower) during July and August, as well as September of below
21 normal and dry water years. During September of wet, above normal, and critical water years and
22 August of critical years, flows under H4_ELT would be up to 166% higher than flows under Existing
23 Conditions. During the other six months of the year, flows under H4_ELT and Existing Conditions
24 would generally be similar, with many exceptions for individual water year types.

25 Mean water temperatures in the Feather River in both above (low-flow channel) and at Thermalito
26 Afterbay (high-flow channel) were examined during the year-round steelhead juvenile rearing
27 period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model*
28 *Results utilized in the Fish Analysis*). At both locations there would be no differences (<5%) in mean
29 water temperatures for any month or water year type.

30 The analysis evaluating the percent of months exceeding water temperature thresholds from NMFS
31 presented in Impacts AQUA-59 and AQUA-76 indicates that there would be a number of small to
32 moderate increases in the percent of months exceeding the NMFS temperature thresholds
33 under H4_ELT relative to Existing Conditions in the low flow channel and at Gridley. These
34 comparisons include the effects of climate change.

35 The analysis evaluating the total degree-months exceeding water temperature thresholds from
36 NMFS presented in Impacts AQUA-59 and AQUA-76 indicates that there would be small to moderate
37 negative effects of H4_ELT relative to Existing Conditions in August in the low flow channel and
38 October and November at Gridley, and no, small or positive effects in the other months at both
39 locations. These comparisons include the effects of climate change.

40 Mean May storage at Oroville would be up to 19% lower under H4_ELT relative to Existing
41 Conditions except in critical years, in which storage would be 15% greater (Table 11-4A-45). Mean
42 September Oroville storage under H4_ELT would be about 24% lower than storage under Existing

1 Conditions for wet, above normal and below normal water years, 32% greater for critical years, and
2 similar for dry years (Table 11-4A-39).

3 *American River*

4 Year-round flows in the American River at the confluence with the Sacramento River under H4_ELT
5 would generally be similar to flows under Existing Conditions during October and December
6 through April, with minor exceptions, and would be up to 47% lower during May through
7 September and November (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

8 Mean water temperatures in the American River at the confluence with the Sacramento River and
9 the Watt Avenue Bridge were examined during the year-round steelhead rearing period (Appendix
10 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in
11 the Fish Analysis*). Mean water temperatures under H4_ELT would be 6% to 7% higher than those
12 under Existing Conditions during October of all but critical water years, and would be similar in the
13 remaining months and water year types.

14 The percent of months exceeding a 65°F temperature threshold in the American River at the Watt
15 Avenue Bridge was evaluated during May through October (Table 11-4A-87). The percent of months
16 under H4_ELT would be greater by up to 37% (absolute difference) than those under Existing
17 Conditions during all months examined.

18 Total degree-months exceeding 65°F were summed by month and water year type at the Watt
19 Avenue Bridge during May through October (Table 11-4A-88). Total degree-months (all water years
20 combined) exceeding the threshold under H4_ELT would be 32 to 168 degree-months greater than
21 those under Existing Conditions for all months.

22 *Stanislaus River*

23 Flows in the Stanislaus River at the confluence with the San Joaquin River were examined for the
24 year-round steelhead rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish
25 Analysis*). Mean flows would generally be similar under H4_ELT relative to Existing Conditions, but
26 with some flow reductions (up to 29%), especially for dry and critical water years during February
27 and March.

28 Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were
29 evaluated during the year-round juvenile steelhead rearing period (Appendix 11D, *Sacramento River
30 Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There
31 would be no differences (<5%) in mean water temperatures throughout the year.

32 *San Joaquin River*

33 Flows in the San Joaquin River at Vernalis were examined for the year-round steelhead rearing
34 period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under
35 H4_ELT would be up to 23% lower during June through August, depending on water year type, than
36 flows under Existing Conditions and would generally be similar in other months, with minor
37 exceptions.

38 Water temperature modeling was not conducted in the San Joaquin River.

1 *Mokelumne River*

2 Flows in the Mokelumne River at the Delta were examined for the year-round steelhead rearing
3 period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under
4 H4_ELT would generally be similar to flows under Existing Conditions during January through May
5 and October and November, with minor exceptions. Flows would generally be lower (up to 34%
6 lower) during June through September, primarily in wet, above normal, and below normal water
7 year types, and would be up to 28% higher in December of the same three water year types.

8 Water temperature modeling was not conducted in the Mokelumne River.

9 Summary of CEQA Conclusion

10 Under Alternative 4A, there are flow reductions in the Feather, American, Stanislaus, San Joaquin,
11 and Mokelumne Rivers and temperature increases in the Sacramento, Feather, American, and
12 Stanislaus Rivers that would lead to reductions in quantity and quality of fry and juvenile steelhead
13 rearing habitat relative to Existing Conditions. Contrary to the NEPA conclusion set forth above,
14 these modeling results indicate that the difference between Existing Conditions and Alternative 4A
15 could be significant because the alternative could substantially reduce rearing habitat and
16 substantially reduce the number of steelhead as a result of fry and juvenile mortality.

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

33 When compared to NAA_ELT and informed by the NEPA analysis above, effects of Alternative 4A on
34 flows would be small and infrequent in the Sacramento River, Clear Creek, and Mokelumne River.
35 Effects in the Feather and American rivers would be variable, but overall effects are expected to be
36 slightly beneficial. Despite the increased flow variations, water temperatures in the Sacramento,
37 Feather, American, and Stanislaus Rivers would not be affected by Alternative 4A. These modeling
38 results represent the increment of change attributable to the alternative, demonstrating the
39 similarities in flows and water temperatures under Alternative 4A and the NAA_ELT, and addressing
40 the limitations of the CEQA baseline (Existing Conditions). Therefore, the impact would be less than
41 significant and no mitigation is required.

1 Impact AQUA-96: Effects of Water Operations on Migration Conditions for Steelhead

2 In general, the effects of Alternative 4A on steelhead migration conditions relative to the NAA_ELT
3 would not be adverse.

4 *Upstream of the Delta*

5 H3_ELT/ESO_ELT

6 *Sacramento River*

7 *Juveniles*

8 Sacramento River flow upstream of Red Bluff during the juvenile steelhead migration period
9 (October through May) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) is used
10 to represent flow conditions in the mainstem of the upper river below Keswick Dam. Mean flows
11 under H3_ELT during this period would generally be similar to flows under NAA_ELT, except during
12 November, during which flows would be 6% to 18% lower than flows under NAA_ELT. These
13 reductions would not have a biologically meaningful effect on steelhead juvenile migration because
14 they would occur during only one of eight months of the period and are small to moderate in
15 magnitude.

16 Mean water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the
17 October through May juvenile steelhead migration period (Appendix 11D, *Sacramento River Water*
18 *Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would
19 be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any month or
20 water year type throughout the period.

21 Overall, these results indicate that H3_ELT would not have biologically meaningful effects on
22 juvenile migration conditions.

23 *Adults*

24 Instream flows upstream of Red Bluff were compared monthly over the period from September
25 through March under H3_ELT and NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the*
26 *Fish Analysis*). Flows under H3_ELT during this period would generally be similar to flows under
27 NAA_ELT, except during November, during which flows would be up to 18% lower than flows under
28 NAA_ELT. These reductions would not have a biologically meaningful effect on steelhead adult
29 migration because they would occur during only one of seven months of the period and are small to
30 moderate in magnitude.

31 Mean water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the
32 September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento*
33 *River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).
34 There would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in
35 any month or water year type throughout the period.

36 *Kelts*

37 Mean Sacramento River flows upstream of Red Bluff under H3_ELT during the March through April
38 steelhead kelt downstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the*

1 *Fish Analysis*) would generally be similar to flows under NAA_ELT. Therefore, H3_ELT would not
2 affect kelt migration in the Sacramento River.

3 Mean water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the
4 March through April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River*
5 *Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There
6 would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any
7 month or water year type throughout the period.

8 Overall in the Sacramento River, these results indicate that H3_ELT would not have biologically
9 meaningful effects on juvenile, adult, or kelt steelhead migration in the Sacramento River.

10 *Clear Creek*

11 No water temperature modeling was conducted in Clear Creek.

12 *Juveniles*

13 Flows in Clear Creek at Whiskeytown were evaluated for the juvenile steelhead migration period
14 (October through May) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean
15 flows under H3_ELT would be similar to flows under NAA_ELT throughout the period. These results
16 indicate that H3_ELT would not affect flow conditions for juvenile steelhead migration in Clear
17 Creek.

18 *Adults*

19 Flows in Clear Creek at Whiskeytown were evaluated for the September through March adult
20 steelhead migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).
21 Mean flows under H3_ELT would be similar to or greater than flows under NAA_ELT throughout the
22 period. These results indicate that H3_ELT would not affect flow conditions for adult steelhead
23 migration in Clear Creek.

24 *Kelts*

25 Flows in Clear Creek at Whiskeytown were evaluated for the March and April kelt steelhead
26 migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows
27 under H3_ELT would be similar to or greater than flows under NAA_ELT for both months of the
28 period. These results indicate that H3_ELT would not affect flow conditions for kelt steelhead
29 migration in Clear Creek.

30 Overall in Clear Creek, these results indicate that effects of H3 on flows would not affect juvenile,
31 adult, or kelt steelhead migration.

32 *Feather River*

33 *Juveniles*

34 Flows in the Feather River at Thermalito Afterbay (high-flow channel) and at the confluence with
35 the Sacramento River were evaluated during the October through May juvenile steelhead migration
36 period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows in the high-
37 flow channel under H3_ELT would generally be similar to or up to 30% greater than flows under

1 NAA_ELT during the period. Increases in flow would have a beneficial effect on migration conditions,
2 particularly in drier water years during some months.

3 Flows under H3_ELT in the Feather River at the confluence with the Sacramento River during
4 October through May would generally be similar to flows under NAA_ELT, with minor exceptions
5 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). These isolated reduction would
6 not have biologically meaningful effects on juvenile steelhead migration conditions.

7 Mean water temperatures in the Feather River at the confluence with the Sacramento River were
8 evaluated during the October through May juvenile steelhead migration period (Appendix 11D,
9 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
10 *Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT
11 and H3_ELT in any month or water year type throughout the period.

12 Overall, there would be no biologically meaningful effects H3 on juvenile migration conditions in the
13 Feather River.

14 *Adults*

15 Flows in the Feather River at Thermalito Afterbay (high-flow channel) and at the confluence with
16 the Sacramento River were evaluated during the September through March adult migration period
17 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows in the high-flow
18 channel under H3_ELT would generally be similar to or up to 30% greater than flows under
19 NAA_ELT except during September. During September, flows would be up to 43% lower for all
20 water year types except critical, in which flows would be 52% greater. These flow reductions would
21 be limited to one month of the seven month migration period and would, therefore, not have a
22 biologically meaningful effect on adult steelhead migration conditions. Mean flows in the Feather
23 River at the confluence with the Sacramento River under H3_ELT would generally be similar to or
24 greater than flows under NAA_ELT, except during September, in which flows would be up to 27%
25 lower for all but critical water years and would be 14% higher for critical years. The flow reductions
26 would be isolated and would, therefore, not have a biologically meaningful effect on adult steelhead
27 migration conditions.

28 Mean water temperatures in the Feather River at the confluence with the Sacramento River were
29 evaluated during the September through March steelhead adult upstream migration period
30 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
31 *utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature
32 between NAA_ELT and H3_ELT in any month or water year type throughout the period.

33 *Kelts*

34 Flows in the Feather River at the Thermalito Afterbay and at the confluence with the Sacramento
35 River were evaluated during the March and April kelt migration period. Flows at Thermalito under
36 H3_ELT during March and April would generally be similar to or, in dry and critical water years, up
37 to 16% greater than flows under NAA_ELT. Flows at the confluence with the Sacramento River
38 would generally be similar to those under NAA_ELT. These results indicate that H3_ELT would not
39 affect kelt steelhead migration conditions in the Feather River.

40 Mean water temperatures in the Feather River at the confluence with the Sacramento River were
41 evaluated during the March through April steelhead kelt downstream migration period (Appendix
42 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in*

1 *the Fish Analysis*). There would be no differences (<5%) in mean water temperature between
2 NAA_ELT and H3_ELT in either month or any water year type of the period.

3 Overall in the Feather River, H3_ELT would not have biologically meaningful effects on juvenile,
4 adult, or kelt steelhead migration.

5 *American River*

6 *Juveniles*

7 Flows in the American River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II*
8 *Model Results utilized in the Fish Analysis*) were evaluated for the juvenile steelhead migration period
9 (October through May). Mean flows under H3_ELT would generally be similar to flows or up to 25%
10 greater than flows under NAA_ELT, except during November, in which flows would be up to 15%
11 lower depending on water year type. Appreciable differences in flow would be too infrequent to
12 have biologically meaningful effects on juvenile steelhead migration.

13 Mean water temperatures in the American River at the confluence with the Sacramento River were
14 evaluated during the October through May juvenile steelhead migration period (Appendix 11D,
15 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
16 *Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT
17 and H3_ELT in any month or water year type throughout the period.

18 Based on its generally small and infrequent effects on mean flow and negligible effects on water
19 temperature, H3_ELT would not affect juvenile steelhead migration in the American River.

20 *Adults*

21 Flows in the American River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II*
22 *Model Results utilized in the Fish Analysis*) were evaluated for the September through March adult
23 migration period. Flows under ELT would generally be similar to or up to 25% greater than flows
24 under NAA_ELT, except during September and November, in which flows would be up to 25% lower,
25 depending on month and water year type. These reductions would be too infrequent to cause
26 biologically meaningful effects on adult steelhead migration.

27 Mean water temperatures in the American River at the confluence with the Sacramento River were
28 evaluated during the September through March steelhead adult upstream migration period
29 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
30 *utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature
31 between NAA_ELT and H3_ELT in any month or water year type throughout the period.

32 *Kelts*

33 Flows in the American River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II*
34 *Model Results utilized in the Fish Analysis*) were evaluated for the March through April kelt migration
35 period. Mean flows under H3_ELT would be similar to flows under NAA_ELT during this period for
36 all water year types.

37 Mean water temperatures in the American River at the confluence with the Sacramento River were
38 evaluated during the March through April steelhead kelt downstream migration period (Appendix
39 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in*

1 *the Fish Analysis*). There would be no differences (<5%) in mean water temperature between
2 NAA_ELT and H3_ELT in any month or water year type of the period.

3 Overall in the American River, the effects of H3_ELT on flows would not affect juvenile, adult, or kelt
4 migration conditions.

5 *Stanislaus River*

6 Mean flows in the Stanislaus River at the confluence with the San Joaquin River for H3_ELT are
7 essentially no different from flows under NAA_ELT for any month. Therefore, there would be no
8 effect of H3_ELT on juvenile, adult, or kelt migration in the Stanislaus River.

9 Further, mean monthly water temperatures in the Stanislaus River at the confluence with the San
10 Joaquin River for H3_ELT are not different from flows under NAA_ELT for any month. Therefore,
11 there would be no effect of H3_ELT on juvenile, adult, or kelt migration in the Stanislaus River.

12 *San Joaquin River*

13 Mean flows in the San Joaquin River at Vernalis for H3_ELT are little different from flows under
14 NAA_ELT for any month. Therefore, there would be no effect of H3_ELT on juvenile, adult, or kelt
15 migration in the San Joaquin River.

16 Water temperature modeling was not conducted in the San Joaquin River.

17 *Mokelumne River*

18 Mean flows in the Mokelumne River at the Delta for H3_ELT are not different from flows under
19 NAA_ELT for any month. Therefore, there would be no effect of H3_ELT on juvenile, adult, or kelt
20 migration in the Mokelumne River.

21 Water temperature modeling was not conducted in the Mokelumne River.

22 H4_ELT /HOS_ELT

23 *Sacramento River*

24 *Juveniles*

25 Mean flows under H4_ELT in the Sacramento River upstream of Red Bluff during the October
26 through May juvenile steelhead migration period would generally be similar to flows under
27 NAA_ELT, except during November, in which flows would be lower for all water year types (9% to
28 15% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). These reductions
29 would not have a biologically meaningful effect on steelhead juvenile migration because they would
30 occur during only one of eight months of the period and are small to moderate in magnitude.

31 Mean water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the
32 October through May juvenile steelhead migration period (Appendix 11D, *Sacramento River Water
33 Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would
34 be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any month or
35 water year type throughout the period.

1 *Adults*

2 Mean flows under H4_ELT in the Sacramento River upstream of Red Bluff during the September
3 through March adult steelhead migration period would generally be similar to flows under
4 NAA_ELT, except during November, in which flows would be 9% to 15% lower (Appendix 11C,
5 *CALSIM II Model Results utilized in the Fish Analysis*). These reductions would not have a biologically
6 meaningful effect on steelhead adult migration because they would occur during only one of eight
7 months of the period and are small to moderate in magnitude.

8 Mean water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the
9 September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento*
10 *River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).
11 There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in
12 any month or water year type throughout the period.

13 *Kelts*

14 Mean flows under H4_ELT in the Sacramento River upstream of Red Bluff during the March through
15 April adult steelhead migration period would be similar to flows under NAA_ELT (Appendix 11C,
16 *CALSIM II Model Results utilized in the Fish Analysis*).

17 Mean water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the
18 March through April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River*
19 *Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There
20 would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any
21 month or water year type throughout the period.

22 *Clear Creek*

23 No water temperature modeling was conducted in Clear Creek.

24 *Juveniles*

25 Mean flows under H4_ELT in Clear Creek at Whiskeytown during the October through May juvenile
26 migration period would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II*
27 *Model Results utilized in the Fish Analysis*).

28 *Adults*

29 Mean flows under H4_ELT in Clear Creek at Whiskeytown during the September through March
30 adult migration period would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM*
31 *II Model Results utilized in the Fish Analysis*).

32 *Kelts*

33 Mean flows under H4_ELT in Clear Creek at Whiskeytown during the March through April kelt
34 migration period would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II*
35 *Model Results utilized in the Fish Analysis*).

1 *Feather River*

2 *Juveniles*

3 Mean flows under H4_ELT in the Feather River at Thermalito Afterbay and the confluence with the
4 Sacramento River during the October through May juvenile migration period would generally be
5 similar to flows under NAA_ELT during October through March, with a few exceptions (Appendix
6 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows during April and May would be
7 greater (up to 548% greater at Thermalito Afterbay location) than flows under NAA_ELT except in
8 critical water years, for which flows would be similar.

9 Mean water temperatures in the Feather River at the confluence with the Sacramento River were
10 evaluated during the October through May juvenile steelhead migration period (Appendix 11D,
11 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
12 *Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT
13 and H4_ELT in any month or water year type throughout the period.

14 *Adults*

15 Mean flows under H4_ELT in the Feather River at Thermalito Afterbay and the confluence with the
16 Sacramento River during the September through March adult migration period would generally be
17 similar to flows under NAA_ELT, except during September (Appendix 11C, *CALSIM II Model Results*
18 *utilized in the Fish Analysis*). During September of critical water years, mean flow under H4_ELT at
19 Thermalito Afterbay would be 52% higher and at the confluence with the Sacramento River it would
20 be 34% higher. During September of the other water year types, mean flows at the two locations
21 would be up to 60% and 38% lower, respectively.

22 Mean water temperatures in the Feather River at the confluence with the Sacramento River were
23 evaluated during the September through March steelhead adult upstream migration period
24 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
25 *utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature
26 between NAA_ELT and H4_ELT in any month or water year type throughout the period.

27 *Kelts*

28 Mean flows under H4_ELT in the Feather River at Thermalito Afterbay and the confluence with the
29 Sacramento River during the March through April kelt migration period would generally be similar
30 to or up to 18% greater than flows under NAA_ELT during March and up to 548% higher than flows
31 under NAA_ELT during April (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

32 Mean water temperatures in the Feather River at the confluence with the Sacramento River were
33 evaluated during the March through April steelhead kelt downstream migration period (Appendix
34 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in*
35 *the Fish Analysis*). There would be no differences (<5%) in mean water temperature between
36 NAA_ELT and H4_ELT in any month or water year type throughout the period.

37 *American River*

38 *Juveniles*

39 Mean flows under H4_ELT in the American River at the confluence with the Sacramento River
40 during the October through May juvenile migration period would generally be similar to flows under

1 NAA_ELT except during October of below normal and critical water years, in which flows under
2 H4_ELT would be 17% and 24% higher, respectively(Appendix 11C, *CALSIM II Model Results utilized*
3 *in the Fish Analysis*).

4 Mean water temperatures in the American River at the confluence with the Sacramento River were
5 evaluated during the October through May juvenile steelhead migration period (Appendix 11D,
6 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
7 *Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT
8 and H4_ELT in any month or water year type throughout the period.

9 *Adults*

10 Mean flows under H4_ELT in the American River at the confluence with the Sacramento River
11 during the September through March adult migration period would generally be similar to flows
12 under H3_ELT except during September of below normal years, in which flows would be 22% lower,
13 and October of below normal and critical water years, in which flows would be 17% and 24% higher
14 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

15 Mean water temperatures in the American River at the confluence with the Sacramento River were
16 evaluated during the September through March steelhead adult upstream migration period
17 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
18 *utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature
19 between NAA_ELT and H4_ELT in any month or water year type throughout the period.

20 *Kelts*

21 Mean flows under H4_ELT in the American River at the confluence with the Sacramento River
22 during the March through April kelt migration period would generally be similar to flows under
23 NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

24 Mean water temperatures in the American River at the confluence with the Sacramento River were
25 evaluated during the March through April steelhead kelt downstream migration period (Appendix
26 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in*
27 *the Fish Analysis*). There would be no differences (<5%) in mean water temperature between
28 NAA_ELT and H4_ELT in any month or water year type throughout the period.

29 *Stanislaus River*

30 Mean flows in the Stanislaus River at the confluence with the San Joaquin River for H4_ELT are
31 essentially the same as flows under NAA_ELT in all months. Therefore, there would be no effect of
32 H4_ELT on juvenile, adult, or kelt migration in the Stanislaus River.

33 Further, mean water temperatures in the Stanislaus River at the confluence with the San Joaquin
34 River for H4_ELT are not different from flows under NAA_ELT for any month. Therefore, there
35 would be no effect of H4_ELT on juvenile, adult, or kelt migration in the Stanislaus River.

36 *San Joaquin River*

37 Mean flows in the San Joaquin River at Vernalis for H4_ELT are little different from flows under
38 NAA_ELT for all months. Therefore, there would be no effect of H4_ELT on juvenile, adult, or kelt
39 migration in the San Joaquin River.

1 Water temperature modeling was not conducted in the San Joaquin River.

2 *Mokelumne River*

3 Mean flows in the Mokelumne River at the Delta for H4_ELT are not different from flows under
4 NAA_ELT for any month. Therefore, there would be no effect of H4_ELT on juvenile, adult, or kelt
5 migration in the Mokelumne River.

6 Water temperature modeling was not conducted in the Mokelumne River.

7 Through-Delta

8 *Sacramento River*

9 *Juveniles*

10 Alternative 4A operations would generally reduce OMR reverse flows under all flow scenarios, with
11 a corresponding increase in net positive downstream flows, during the outmigration period of
12 steelhead through the interior Delta channels (Appendix B, Supplemental Modeling for Alternative
13 4A). Conditions under Scenario H4_ELT would further improve overall average OMR flows relative
14 to other flow scenarios under Alternative 4A. These improved net positive downstream flows would
15 be substantial benefits of the proposed operations.

16 As noted under Predation Associated with Entrainment above, predation at the north Delta would
17 be increased due to the construction of the proposed SWP/CVP water export facilities on the
18 Sacramento River. It is assumed that per capita steelhead predation losses would be similar to those
19 predicted for spring-run Chinook salmon, although slightly reduced because of the larger size of
20 steelhead outmigrants. Bioenergetics modeling predicts a predation loss of about 0.2% of the
21 juvenile spring-run population (Table 11-4A-26).

22 Based on DPM results for spring-run Chinook salmon (Impact AQUA-60 for Alternative 4A), changes
23 in steelhead survival relative to NAA_ELT would be expected to be limited under Alternative 4A.
24 Also, steelhead juveniles are larger than Chinook salmon juveniles in general, and therefore may be
25 less vulnerable to predation during migration. The DPM analysis of Alternative 4A on juvenile
26 spring-run Chinook salmon migration suggests a potential adverse effect of small magnitude. As
27 noted for spring-run Chinook salmon, this adverse effect would be minimized through the bypass
28 flow criteria and real-time operations outlined above, as well as inclusion within Alternative 4A of
29 specific important conservation measures. These conservation measures include *Environmental*
30 *Commitment 6 Channel Margin Enhancement* to offset loss of channel margin habitat to the NDD
31 footprint and far-field (water level) effects, *Environmental Commitment 15 Localized Reduction of*
32 *Predatory Fishes* to limit predation potential at the NDD and *Environmental Commitment 16*
33 *Nonphysical Fish Barriers* to reduce entry of spring-run Chinook salmon juveniles into the low-
34 survival interior Delta. Therefore the effect on juvenile steelhead outmigration success through the
35 Delta under Alternative 4A would not be adverse.

36 *Adults*

37 The upstream adult steelhead migration occurs from September–March, peaking during December-
38 February. The steelhead kelt downstream migration occurs from January–April. The proportion of
39 Sacramento River water in the Delta under Alternative 4A would be similar (8% or less difference)
40 to NAA_ELT throughout the adult steelhead upstream migration (Table 11-4A-89). Under

1 **Alternative 4A's Scenario H3_ELT, mean monthly Sacramento River flows at Rio Vista averaged over**
2 all water years would be reduced compared to NAA_ELT, ranging from 46% less in September to
3 7.5% less in December. For H4_ELT, the range is from about 1% less in April to 30% less in October
4 and November. These differences are less than those observed under Alternative 1A and so, because
5 the effect under Alternative 1A would not be adverse, Alternative 4A would also not have an adverse
6 effect on adult and kelt steelhead migration through the Delta.

7 *San Joaquin River*

8 *Juveniles*

9 The only changes to San Joaquin River flows at Vernalis would result from the modeled effects of
10 climate change on inflows to the river downstream of Friant Dam and reduced tributary inflows.
11 There are no flow changes associated with Alternative 4A Alternative 4A would have no effect on
12 steelhead migration success through the Delta from the perspective of changing inflows into the
13 Delta. However, juvenile steelhead migration success would be aided by the inclusion in the water
14 conveyance facilities of an operable barrier at the head of Old River, which would keep flow and fish
15 in the mainstem San Joaquin River.

16 *Adults*

17 Alternative 4A Scenario H3_ELT would slightly increase the proportion of San Joaquin River water in
18 the Delta in September through March by 1.3 to 4.4 % (compared to NAA_ELT) (Table 11-4A-89).
19 The proportion of San Joaquin River water under Scenario H3_ELT would be similar or slightly more
20 than NAA_ELT. Conditions under Scenario H4_ELT are expected to increase the proportion of San
21 Joaquin River water (relative to the change under Scenario H3_ELT) because it would involve fewer
22 exports from the north Delta during spring.

1 Table 11-4A-89. Percentage (%) of Water at Collinsville that Originated in the Sacramento River
 2 and San Joaquin River during the Adult Steelhead Migration Period for Alternative 4A

| Month | EXISTING CONDITIONS | NAA_ELT | H3_ELT | EXISTING CONDITIONS vs. H3_ELT | NAA_ELT vs. H3_ELT |
|-------------------|------------------------|---------|--------|--------------------------------------|-----------------------|
| Sacramento River | | | | | |
| September | 60 | 65 | 61 | 0 | -4 |
| October | 60 | 64 | 65 | 5 | 1 |
| November | 60 | 64 | 63 | 3 | -1 |
| December | 67 | 67 | 65 | -1 | -1 |
| January | 76 | 75 | 73 | -2 | -2 |
| February | 75 | 74 | 69 | -6 | -4 |
| March | 78 | 77 | 69 | -9 | -8 |
| San Joaquin River | | | | | |
| September | 0.3 | 0.2 | 1.7 | 1.4 | 1.5 |
| October | 0.2 | 0.2 | 3.5 | 3.4 | 3.3 |
| November | 0.4 | 0.8 | 5.2 | 4.8 | 4.4 |
| December | 0.9 | 1.0 | 2.9 | 2.0 | 1.9 |
| January | 1.6 | 1.7 | 2.9 | 1.3 | 1.3 |
| February | 1.4 | 1.5 | 3.6 | 2.2 | 2.2 |
| March | 2.6 | 2.6 | 5.7 | 3.1 | 3.1 |

Shading indicates 10% or greater absolute difference.

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

3
 4 *NEPA Effects:* Upstream of the Delta, these modeling results indicate that the effect is not adverse
 5 because it would not substantially reduce the amount of suitable habitat or substantially interfere
 6 with the movement of fish. Effects of Alternative 4A in all locations analyzed would consist primarily
 7 of negligible effects on mean monthly flow and water temperatures for the juvenile, adult, and kelt
 8 migration periods. In the Feather River, higher flows during spring months may provide some
 9 benefits to migrating steelhead. Effects of Alternative 4A on upstream water temperatures would be
 10 negligible.

11 Near-field effects of Alternative 4A NDD on Sacramento River steelhead related to impingement and
 12 predation associated with three new intake structures could result in negative effects on juvenile
 13 migrating steelhead, although there is high uncertainty regarding the overall effects. Estimates
 14 within the effects analysis range from very low levels of effects (<1% mortality) to more significant
 15 effects (~ 12% mortality above current baseline levels). Environmental Commitment 15 would be
 16 implemented with the intent of providing localized and temporary reductions in predation pressure
 17 at the NDD. Additionally, as described in the adaptive management and monitoring program in
 18 Section 4.1, several pre-construction surveys to better understand how to minimize losses
 19 associated with the three new intake structures will be implemented as part of the final NDD screen
 20 design effort. Similarly, Alternative 4A also includes investigations to better understand factors
 21 affecting juvenile through-Delta migration (as described in the adaptive management and
 22 monitoring program in Section 4.1) and includes biologically-based triggers to inform real-time

1 operations of the NDD, intended to provide adequate migration conditions for downstream-
2 migrating juvenile salmonids. However, at this time, due to the absence of comparable facilities
3 anywhere in the lower Sacramento River/Delta, the degree of predation-related mortality expected
4 from near-field effects at the NDD remains highly uncertain.

5 As noted for other salmonids, two recent studies (Newman 2003 and Perry 2010) indicate that far-
6 field effects associated with the new intakes could cause a reduction in smolt survival in the
7 Sacramento River downstream of the NDD intakes due to reduced flows in this area, although these
8 modeling results focused on juvenile Chinook salmon as opposed to steelhead. As noted for winter-
9 run and spring-run Chinook salmon above, the elements of Alternative 4A related to reduced
10 interior Delta entry (Environmental Commitment 16) and reduced south Delta entrainment may
11 offset the far-field effects of reduced flow. As noted for the various Chinook salmon runs, the overall
12 magnitude of each of these factors and how they might interact and/or offset each other in affecting
13 salmonid survival through the plan area is uncertain, and will be investigated as part of the adaptive
14 management and monitoring program.

15 Adverse effects of the water conveyance facilities operations at the NDD would be minimized
16 through the bypass flow criteria and real-time operations described for other salmonids (e.g.,
17 winter-run Chinook salmon), as well as inclusion within Alternative 4A of specific important
18 conservation measures: *Environmental Commitment 6 Channel Margin Enhancement* to offset loss of
19 channel margin habitat to the NDD footprint and far-field (water level) effects, *Environmental*
20 *Commitment 15 Localized Reduction of Predatory Fishes* to limit predation potential at the NDD and
21 *Environmental Commitment 16 Nonphysical Fish Barriers* to reduce entry of juvenile salmonids into
22 the low-survival interior Delta.

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

29 Upstream of the Delta

30 H3_ELT/ESO_ELT

31 *Sacramento River*

32 *Juveniles*

33 Flows in the Sacramento River just upstream of Red Bluff Diversion Dam were evaluated for the
34 juvenile migration period (October through May) (Appendix 11C, *CALSIM II Model Results utilized in*
35 *the Fish Analysis*). Mean flows under H3_ELT would generally be similar to those under Existing
36 Conditions, except during October and November, in which flows would be up to 16% lower than
37 those under Existing Conditions. These reductions in flow would be too small and infrequent to have
38 biologically meaningful negative effects on migration conditions.

39 Mean water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the
40 October through May juvenile steelhead migration period (Appendix 11D, *Sacramento River Water*

1 *Quality Model and Reclamation Temperature Model Results Utilized in the Fish Analysis*). There would
2 be no differences (<5%) in mean water temperature between Existing Conditions.

3 *Adults*

4 Mean flows under H3_ELT during the adult migration period (September through March) would
5 generally be similar to those under Existing Conditions, except during September through
6 November October, in which flows would be up to 22% lower than those under Existing Conditions
7 (*Appendix 11C, CALSIM II Model Results utilized in the Fish Analysis*) The changes in flow due to
8 H3_ELT would be frequent enough (3 of 7 months), large enough (up to 22% lower), and occur
9 during all water year types to be considered biologically meaningful negative effects on adult
10 migration conditions.

11 Mean water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the
12 September through March steelhead adult upstream migration period (*Appendix 11D, Sacramento
13 River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).
14 There would be no differences (<5%) in mean water temperature between Existing Conditions and
15 H3_ELT in all months except September and October, in which temperatures under H3_ELT would
16 be 6% greater than those under Existing Conditions.

17 *Kelts*

18 Mean flows under H3_ELT during the kelt migration period (March and April) would be similar to
19 those under Existing Conditions for all water year types (*Appendix 11C, CALSIM II Model Results
20 utilized in the Fish Analysis*).

21 Mean water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the
22 March through April steelhead kelt downstream migration period (*Appendix 11D, Sacramento River
23 Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There
24 would be no differences (<5%) in mean water temperature between Existing Conditions and
25 H3_ELT in any month or water year type throughout the period.

26 Overall in the Sacramento River, H3_ELT would not affect flow or water temperature conditions for
27 juvenile, adult, or kelt steelhead migration.

28 *Clear Creek*

29 No water temperature modeling was conducted in Clear Creek.

30 *Juveniles*

31 Flows under H3_ELT in Clear Creek at Whiskeytown during the October through May juvenile
32 migration period would generally be similar to flows under Existing Conditions, except for 40%
33 higher flow in January of wet years and 10% higher flows in December through April of critical
34 water years (*Appendix 11C, CALSIM II Model Results utilized in the Fish Analysis*).

35 *Adults*

36 Flows under H3_ELT in Clear Creek at Whiskeytown during the September through March adult
37 migration period would generally be similar to flows under Existing Conditions, except for 40%
38 higher flow in January of wet water years, 10% higher flows in December through March of critical

1 years, and 19% lower flow in September of critical years (Appendix 11C, *CALSIM II Model Results*
2 *utilized in the Fish Analysis*).

3 *Kelts*

4 Flows under H3_ELT in Clear Creek at Whiskeytown during the March through April kelt migration
5 period would generally be similar to flows under Existing Conditions (Appendix 11C, *CALSIM II*
6 *Model Results utilized in the Fish Analysis*).

7 Overall in Clear Creek, H3_ELT would not affect flow or water temperature conditions for juvenile,
8 adult, or kelt steelhead migration.

9 *Feather River*

10 *Juveniles*

11 Mean flows were evaluated in the Feather River at Thermalito Afterbay during the October through
12 May juvenile migration period. Flows under H3_ELT would be similar to flows under Existing
13 Conditions during October through December and March, up to 48% lower than flows under
14 Existing Conditions during January and February, and up to 33% greater than flows under Existing
15 Conditions during April and May (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
16 *Analysis*). Flows at the confluence with the Sacramento River under H3_ELT would generally be
17 similar to those under Existing Conditions throughout the period.

18 Mean water temperatures in the Feather River at the confluence with the Sacramento River were
19 evaluated during the October through May juvenile steelhead migration period (Appendix 11D,
20 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
21 *Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing
22 Conditions and H3_ELT in all months and water year types of the migration period.

23 *Adults*

24 Mean flows were examined in the Feather River at Thermalito Afterbay during the September
25 through March adult migration period. Flows under H3_ELT would be up to 192% greater than
26 flows under Existing Conditions during September, similar to flows under Existing Conditions
27 during October through December and March, and up to 48% lower than flows under Existing
28 Conditions during January and February (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
29 *Analysis*). The mean flows at the confluence with the Sacramento River under H3_ELT would
30 generally be similar or up to 19% lower than those under Existing Conditions during November
31 through March and similar or up to 21% higher during October, while flows in September would
32 range from 28% lower to 100% higher, depending on water year type.

33 Mean water temperatures in the Feather River at the confluence with the Sacramento River were
34 evaluated during the September through March steelhead adult upstream migration period
35 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
36 *utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature
37 between Existing Conditions and H3_ELT in all months and water year types of the period.

38 *Kelts*

39 Mean flows under H3_ELT in the Feather River at Thermalito Afterbay during the March through
40 April kelt migration period would be similar to flows under Existing Conditions during March and

1 up to 29% higher than flows under Existing Conditions during April (Appendix 11C, *CALSIM II Model*
2 *Results utilized in the Fish Analysis*). Mean flows for March and April at the confluence with the
3 Sacramento River would generally be similar between H3_ELT and Existing Conditions.

4 Mean water temperatures in the Feather River at the confluence with the Sacramento River were
5 evaluated during the March through April steelhead kelt downstream migration period (Appendix
6 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in*
7 *the Fish Analysis*). There would be no differences (<5%) in mean water temperature between
8 Existing Conditions and H3_ELT in any month or water year type throughout the period.

9 Overall in the Feather River, the effect of H3_ELT on flows would include frequent substantial
10 reductions in flows that would affect juvenile and adult migration conditions, particularly in drier
11 water years, but would generally not affect kelt migration.

12 *American River*

13 *Juveniles*

14 Mean flows under H3_ELT in the American River at the confluence with the Sacramento River
15 during the October through May juvenile migration period would generally be similar to or up to
16 15% higher than flows under Existing Conditions, except during November, January, and May, in
17 which flows would be up to 24% lower under H3_ELT (Appendix 11C, *CALSIM II Model Results*
18 *utilized in the Fish Analysis*).

19 Mean water temperatures in the American River at the confluence with the Sacramento River were
20 evaluated during the October through May juvenile steelhead migration period (Appendix 11D,
21 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
22 *Fish Analysis*). Mean water temperatures under H3_ELT would be no different (<5%) from those
23 under Existing Conditions, except in October, for which the water temperatures would 5% to 6%
24 higher for all but critical water years.

25 *Adults*

26 Flows under H3_ELT in the American River at the confluence with the Sacramento River during the
27 September through March adult migration period would generally be similar to or up to 15% higher
28 than flows under Existing Conditions, except during September, November, and January, in which
29 flows would be up to 47% lower (September of critical water years) than under Existing Conditions
30 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

31 Mean water temperatures in the American River at the confluence with the Sacramento River were
32 evaluated during the September through March steelhead adult upstream migration period
33 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
34 *utilized in the Fish Analysis*). Mean water temperatures under H3_ELT would be no different (<5%)
35 from those under Existing Conditions, except in October, for which the water temperatures would
36 5% to 6% higher for all but critical water years.

37 *Kelts*

38 Flows under H3_ELT in the American River at the confluence with the Sacramento River during the
39 March through April kelt migration period would generally be similar to flows under Existing

1 Conditions, except for March of critical water years, in which the mean flow would be 12% lower
2 under H3_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

3 Mean water temperatures in the American River at the confluence with the Sacramento River were
4 evaluated during the March and April steelhead kelt downstream migration period (Appendix 11D,
5 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
6 *Fish Analysis*). Mean water temperatures under H3_ELT would be no different (<5%) from those
7 under Existing Conditions.

8 Overall in the American River, the effect of H3_ELT on flows would include frequent moderate
9 reductions in flows that would affect juvenile and adult migration conditions, particularly in drier
10 water years, but would generally not affect kelt migration

11 *Stanislaus River*

12 *Juveniles*

13 Flows in the Stanislaus River at the confluence with the San Joaquin River were evaluated for the
14 October through May steelhead juvenile downstream migration period (Appendix 11C, *CALSIM II*
15 *Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to
16 flows under Existing Conditions during October through January and up to 29% lower than flows
17 under Existing Conditions during February through May.

18 Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were
19 evaluated during the October through May steelhead juvenile downstream migration period
20 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
21 *utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperatures
22 between H3_ELT and Existing Conditions.

23 *Adults*

24 Flows in the Stanislaus River at the confluence with the San Joaquin River were evaluated for the
25 September through March steelhead adult upstream migration period (Appendix 11C, *CALSIM II*
26 *Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to
27 or up to 29% lower (February of critical water years) than flows under Existing Conditions
28 depending on month and water year type.

29 Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were
30 evaluated during the September through March steelhead adult upstream migration period
31 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
32 *utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperatures
33 between H3_ELT and Existing Conditions.

34 *Kelt*

35 Flows in the Stanislaus River at the confluence with the San Joaquin River were evaluated for the
36 March and April steelhead kelt downstream migration period (Appendix 11C, *CALSIM II Model*
37 *Results utilized in the Fish Analysis*). Mean flows during the period under H3_ELT would be up to
38 23% over than flows under Existing Conditions.

39 Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were
40 evaluated during the March and April steelhead kelt downstream migration period (Appendix 11D,

1 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
2 *Fish Analysis*). There would be no differences (<5%) in mean water temperatures between H3_ELT
3 and Existing Conditions.

4 *San Joaquin River*

5 Water temperature modeling was not conducted in the San Joaquin River.

6 *Juveniles*

7 Flows in the San Joaquin River at Vernalis were evaluated for the October through May steelhead
8 juvenile downstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
9 *Analysis*). Mean flows under H3_ELT would generally be similar to flows under Existing Conditions,
10 with minor exceptions.

11 *Adults*

12 Flows in the San Joaquin River at Vernalis were evaluated for the September through March
13 steelhead adult upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the*
14 *Fish Analysis*). Mean flows under H3_ELT would generally be similar to flows under Existing
15 Conditions, with minor exceptions.

16 *Kelt*

17 Flows in the San Joaquin River at Vernalis were evaluated for the March and April steelhead kelt
18 downstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).
19 Mean flows under H3_ELT would generally be similar to flows under Existing Conditions, with
20 minor exceptions.

21 *Mokelumne River*

22 Water temperature modeling was not conducted in the Mokelumne River.

23 *Juveniles*

24 Flows in the Mokelumne River at Delta were evaluated for the October through May steelhead
25 juvenile downstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
26 *Analysis*). Mean flows under H3_ELT would generally be lower than flows under Existing Conditions
27 during April and May (up to 11% lower), similar to flows under Existing Conditions during October,
28 November, and January through March, and higher than flows under Existing Conditions during
29 December (up to 28% higher).

30 *Adults*

31 Flows in the Mokelumne River at Delta were evaluated for the September through March steelhead
32 adult upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
33 *Analysis*). Mean flows under H3_ELT would generally be similar to flows under Existing Conditions,
34 except during December, in which mean flow would be up to 28% higher, and during September,
35 when flows would be up to 22% lower.

1 *Kelt*

2 Flows in the Mokelumne River at Delta were evaluated for the March and April steelhead kelt
3 downstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).
4 Mean flows under H3_ELT would generally be similar to flows under Existing Conditions during
5 both months of the period.

6 H4_ELT /ESO_ELT

7 *Sacramento River*

8 *Juveniles*

9 Flows in the Sacramento River just upstream of Red Bluff Diversion Dam were evaluated for the
10 juvenile migration period (October through May) (Appendix 11C, *CALSIM II Model Results utilized in*
11 *the Fish Analysis*). Mean flows under H4_ELT would generally be similar to those under Existing
12 Conditions.

13 Mean water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the
14 October through May juvenile steelhead migration period (Appendix 11D, *Sacramento River Water*
15 *Quality Model and Reclamation Temperature Model Results Utilized in the Fish Analysis*). There would
16 be no differences (<5%) in mean water temperature between Existing Conditions and H4_ELT in any
17 month or water year type throughout the period.

18 *Adults*

19 Mean flows under H4_ELT during the adult migration period (September through March) would
20 generally be similar to those under Existing Conditions except during September, in which flows
21 would be up to 49% higher for wet and above normal water years and up to 18% lower for dry and
22 critical water years (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). The
23 changes in flow would be too infrequent to have biologically meaningful negative effects on
24 migration conditions.

25 Mean temperatures in the Sacramento River upstream of Red Bluff were evaluated during the
26 September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento*
27 *River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).
28 There would be no differences (<5%) in mean water temperature between Existing Conditions and
29 H4_ELT in any month or water year type throughout the period.

30 *Kelts*

31 Mean flows under H4_ELT during the kelt migration period (March and April) would generally be
32 similar to those under Existing Conditions for all water year types (Appendix 11C, *CALSIM II Model*
33 *Results utilized in the Fish Analysis*).

34 Mean water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the
35 March through April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River*
36 *Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There
37 would be no differences (<5%) in mean water temperature between Existing Conditions and
38 H4_ELT in any month or water year type in the period.

1 Overall in the Sacramento River, H4_ELT would not affect flow or water temperature conditions for
2 juvenile, adult, or kelt steelhead migration.

3 *Clear Creek*

4 No water temperature modeling was conducted in Clear Creek.

5 *Juveniles*

6 Flows under H4_ELT in Clear Creek at Whiskeytown during the October through May juvenile
7 migration period would generally be similar to flows under Existing Conditions, except for 40%
8 higher flow in January of wet years, 10% higher flows in December through April of critical water
9 years, and other minor exceptions (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
10 *Analysis*).

11 *Adults*

12 Flows under H4_ELT in Clear Creek at Whiskeytown during the September through March adult
13 migration period would generally be similar to flows under Existing Conditions, except for 40%
14 higher flow in January of wet water years, 10% higher flows in December through March of critical
15 years, and other minor exceptions (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
16 *Analysis*).

17 *Kelts*

18 Flows under H4_ELT in Clear Creek at Whiskeytown during the March through April kelt migration
19 period would generally be similar to flows under Existing Conditions, except for 13% higher flows in
20 March of below normal water years and 10% higher flows in March and April of critical water years
21 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

22 Overall in Clear Creek, H4_ELT would not affect flow or water temperature conditions for juvenile,
23 adult, or kelt steelhead migration.

24 *Feather River*

25 *Juveniles*

26 Mean flows under H4_ELT in the Feather River at Thermalito Afterbay during the October through
27 May juvenile migration period would generally be lower (up to 36% lower) than flows under
28 Existing Conditions during October through March and would be much higher for all water year
29 types except critical during April and May (up to 509% higher) (Appendix 11C, *CALSIM II Model*
30 *Results utilized in the Fish Analysis*). Mean flow for April with all water years combined would be
31 92% greater than that under Existing Conditions. The flows at the confluence with the Sacramento
32 River under H4_ELT would generally be similar or up to 26% lower (December of critical water
33 years) than those under Existing Conditions during October through March and up to 112% higher
34 in April and May.

35 Mean temperatures in the Feather River at the confluence with the Sacramento River were
36 evaluated during the October through May juvenile steelhead migration period (Appendix 11D,
37 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
38 *Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing
39 Conditions and H4_ELT in all months and water year types of the migration period.

1 *Adults*

2 Mean flows under H4_ELT in the Feather River at Thermalito Afterbay during the September
3 through March adult migration period would generally be lower (up to 36% lower) than flows
4 under Existing Conditions during October through March (Appendix 11C, *CALSIM II Model Results*
5 *utilized in the Fish Analysis*). Mean flows in September under H4_ELT would be up to 166% higher
6 for wet, above normal and critical water years, and up to 49% lower for below normal and dry water
7 years. The flows at the confluence with the Sacramento River under H4_ELT would generally be
8 similar or up to 26% lower than those under Existing Conditions during October through March,
9 while flows in September would range from 29% lower to 87% higher depending on water year
10 type.

11 Mean water temperatures in the Feather River at the confluence with the Sacramento River were
12 evaluated during the September through March steelhead adult upstream migration period
13 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
14 *utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature
15 between Existing Conditions and H4_ELT in all months and water year types of the period.

16 *Kelts*

17 Mean flows under H4_ELT in the Feather River at Thermalito Afterbay during the March and April
18 kelt migration period would range from 22% lower to 16% higher in March and from 4% to 509%
19 higher in April (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows at
20 the confluence with the Sacramento River for March would generally be similar between H4_ELT
21 and Existing Conditions, while flows in April would be up to 112% higher under H4_ELT.

22 Mean water temperatures in the Feather River at the confluence with the Sacramento River were
23 evaluated during the March through April steelhead kelt downstream migration period (Appendix
24 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in*
25 *the Fish Analysis*). There would be no differences (<5%) in mean water temperature between
26 Existing Conditions and H4_ELT in any month or water year type throughout the period.

27 Overall in the Feather River, the effect of H4_ELT on flows would include persistent and/or
28 substantial reductions in flows that would affect juvenile and adult migration conditions,
29 particularly in drier water years.

30 *American River*

31 *Juveniles*

32 Mean flows under H4_ELT in the American River at the confluence with the Sacramento River
33 during the October through May juvenile migration period would generally be similar to or up to
34 15% higher than flows under Existing Conditions, except during November and May, in which flows
35 would be up to 25% lower under H4_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
36 *Analysis*).

37 Mean water temperatures in the American River at the confluence with the Sacramento River were
38 evaluated during the October through May juvenile steelhead migration period (Appendix 11D,
39 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
40 *Fish Analysis*). Mean water temperatures under H4_ELT would be no different (<5%) from those

1 under Existing Conditions, except in October, for which the water temperatures would 5% to 6%
2 higher for all but critical water years.

3 *Adults*

4 Flows under H4_ELT in the American River at the confluence with the Sacramento River during the
5 September through March adult migration period would generally be similar to or up to 15% higher
6 than flows under Existing Conditions, except during September and November, in which flows
7 would be up to 47% lower (September of critical water years) than under Existing Conditions
8 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

9 Mean water temperatures in the American River at the confluence with the Sacramento River were
10 evaluated during the September through March steelhead adult upstream migration period
11 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
12 *utilized in the Fish Analysis*). Mean water temperatures under H4_ELT would be no different (<5%)
13 from those under Existing Conditions, except in October, for which the water temperatures would
14 5% to 6% higher for all but critical water years.

15 *Kelts*

16 Flows under H4_ELT in the American River at the confluence with the Sacramento River during the
17 March through April kelt migration period would generally be similar to flows under Existing
18 Conditions, except for March of critical years, during which the mean flow would be 12% lower
19 under H4_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

20 Mean water temperatures in the American River at the confluence with the Sacramento River were
21 evaluated during the March and April steelhead kelt downstream migration period (Appendix 11D,
22 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
23 *Fish Analysis*). Mean water temperatures under H4_ELT would be no different (<5%) from those
24 under Existing Conditions.

25 Overall in the American River, reductions inflows would be too small and infrequent to affect
26 migration conditions for steelhead.

27 *Stanislaus River*

28 *Juveniles*

29 Flows in the Stanislaus River at the confluence with the San Joaquin River were evaluated for the
30 October through May steelhead juvenile downstream migration period (Appendix 11C, *CALSIM II*
31 *Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would generally be similar to
32 flows under Existing Conditions during October through January and up to 29% lower than flows
33 under Existing Conditions during February through May.

34 Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were
35 evaluated during the October through May steelhead juvenile downstream migration period
36 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
37 *utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperatures
38 between H4_ELT and Existing Conditions.

1 *Adults*

2 Flows in the Stanislaus River at the confluence with the San Joaquin River were evaluated for the
3 September through March steelhead adult upstream migration period (Appendix 11C, *CALSIM II*
4 *Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would generally be similar to
5 flows under Existing Conditions during September through January and up to 29% lower than flows
6 under Existing Conditions during February and March.

7 Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were
8 evaluated during the September through March steelhead adult upstream migration period
9 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
10 *utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperatures
11 between H4_ELT and Existing Conditions.

12 *Kelt*

13 Flows in the Stanislaus River at the confluence with the San Joaquin River were evaluated for the
14 March and April steelhead kelt downstream migration period (Appendix 11C, *CALSIM II Model*
15 *Results utilized in the Fish Analysis*). Mean flows under H4_ELT would be lower (by up to 23%) than
16 flows under Existing Conditions in both months.

17 Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were
18 evaluated during the March and April steelhead kelt downstream migration period (Appendix 11D,
19 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
20 *Fish Analysis*). There would be no differences (<5%) in mean water temperatures between H4_ELT
21 and Existing Conditions.

22 *San Joaquin River*

23 Water temperature modeling was not conducted in the San Joaquin River.

24 *Juveniles*

25 Flows in the San Joaquin River at Vernalis were evaluated for the October through May steelhead
26 juvenile downstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
27 *Analysis*). Mean flows under H4_ELT would generally be similar to flows under Existing Conditions,
28 except during March and April (up to 12% lower).

29 *Adults*

30 Flows in the San Joaquin River at Vernalis were evaluated for the September through March
31 steelhead adult upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the*
32 *Fish Analysis*). Mean flows under H4_ELT would generally be similar to flows under Existing
33 Conditions, except during March (up to 12% lower)

34 *Kelt*

35 Flows in the San Joaquin River at Vernalis were evaluated for the March and April steelhead kelt
36 downstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).
37 Mean flows under H4_ELT would generally be lower than flows under Existing Conditions (up to
38 12% lower)

1 *Mokelumne River*

2 Water temperature modeling was not conducted in the Mokelumne River.

3 *Juveniles*

4 Flows in the Mokelumne River at Delta were evaluated for the October through May steelhead
5 juvenile downstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
6 *Analysis*). Mean flows under H4_ELT would generally be lower than flows under Existing Conditions
7 during April and May (up to 11% lower), similar to flows under Existing Conditions during October,
8 November, and January through March, and higher than flows under Existing Conditions during
9 December (up to 28% higher).

10 *Adults*

11 Flows in the Mokelumne River at Delta were evaluated for the September through March steelhead
12 adult upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
13 *Analysis*). Mean flows under H4_ELT would generally be lower than flows under Existing Conditions
14 during September (up to 22% lower), similar to flows under Existing Conditions during October,
15 November, and January through March, and higher than flows under Existing Conditions during
16 December (up to 28% higher).

17 *Kelt*

18 Flows in the Mokelumne River at Delta were evaluated for the March and April steelhead kelt
19 downstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).
20 Mean flows under H4_ELT would be similar to flows under Existing Conditions during March and up
21 to 7% lower than flows under Existing Conditions during April.

22 Through-Delta

23 Based on DPM results for spring-run Chinook salmon, which do not assume any adjustments in
24 operations based on fish presence, steelhead survival would not be expected to decrease more than
25 1%. Assuming similar effects on steelhead, Alternative 4A would have a minimal effect on steelhead
26 migration success through the Delta. Therefore, the impact on juvenile steelhead migration through
27 the Delta would be small, particularly given the inclusion in Alternative 4A of Environmental
28 Commitments 6, 15, and 16 (see additional discussion in the *Summary of CEQA Conclusion* below).

29 The proportion of Sacramento River water in the Delta under Alternative 4A Scenario H3_ELT would
30 be similar to Existing Conditions (<10% difference) during the entire adult steelhead upstream
31 migration (Table 11-4A-89). As discussed in more detail for Alternative 4, because of the overall
32 similarity in olfactory cues and Rio Vista flows between Alternative 1A and Alternative 4A during
33 the entire adult and kelt migration periods, effects on migration success would be expected to be
34 similar to Alternative 1A. Olfactory cues and flows in the San Joaquin River basin would be improved
35 or similar to Alternative 1A and Existing Conditions. Overall, the impact to steelhead adult and kelt
36 migration under Alternative 4A is considered negligible.

37 Summary of CEQA Conclusion

38 Under Alternative 4A, there would be reductions in flow in the Sacramento, Feather, American,
39 Stanislaus, and Mokelumne Rivers that would lead to biologically meaningful reductions in juvenile
40 and adult migration conditions, thereby reducing survival relative to Existing Conditions. Reduced

1 migration conditions would delay or eliminate successful migration necessary to complete the
2 steelhead life cycle. Alternative 4A would not affect migration conditions for steelhead in Clear
3 Creek or the San Joaquin River. Water temperatures under Alternative 4A would generally be
4 similar to those under Existing Conditions in all rivers examined. There would be minimal effects on
5 through-Delta migration conditions because changes in juvenile survival and adult olfactory cues
6 would be small. Contrary to the NEPA conclusion set forth above, these modeling results indicate
7 that the difference between Existing Conditions and Alternative 4A could be significant because the
8 alternative could substantially reduce migration conditions for steelhead.

9 However, this interpretation of the biological modeling is likely attributable to different modeling
10 assumptions for four factors: sea level rise, climate change, future water demands, and
11 implementation of the alternative. As discussed in Section 11.3.3, *Effects and Mitigation Approaches*,
12 in the Draft EIR/EIS, because of differences between the CEQA and NEPA baselines, it is sometimes
13 possible for CEQA and NEPA significance conclusions to differ from one another under the same
14 impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was
15 prepared. Both the action alternative and the NEPA baseline (NAA_ELТ) models anticipated future
16 conditions that would occur at 2025 (ELТ implementation period), including the projected effects of
17 climate change (precipitation patterns), sea level rise and future water demands, as well as
18 implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because
19 the action alternative modeling does not partition the effects of implementation of the alternative
20 from the effects of sea level rise, climate change, and future water demands, the comparison to
21 Existing Conditions may not offer a clear understanding of the impact of the alternative on the
22 environment. This suggests that the comparison in results between the alternative and NAA_ELТ, is
23 a better approach because it isolates the effect of the alternative from those of sea level rise, climate
24 change, and future water demands.

25 When compared to NAA_ELТ and informed by the NEPA analysis above, there would be negligible
26 effects on mean monthly flow and water temperatures for the juvenile, adult, and kelt migration
27 periods. Effects of. Near-field effects of Alternative 4A NDD on Sacramento River steelhead related to
28 impingement and predation associated with the intake structures could result in negative effects on
29 juvenile migrating steelhead, although there is high uncertainty regarding overall effects.

30 As noted for other salmonids such as winter-run Chinook salmon, similar or slightly lower survival
31 than for Existing Conditions based on the water conveyance facilities operations would be offset by
32 the inclusion of bypass flow criteria, real-time operational adjustments, *Environmental Commitment*
33 *6 Channel Margin Enhancement*, *Environmental Commitment 15 Localized Reduction of Predatory*
34 *Fishes*, and *Environmental Commitment 16 Nonphysical Barriers*. Overall, it is concluded that the
35 impact to steelhead would be less than significant and no mitigation would be required.

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

38 As described for winter-run Chinook salmon, Alternative 4A includes a greatly reduced extent of
39 restoration measures relative to Alternative 4A and Alternative 1A. The mechanisms of impacts of
40 habitat restoration discussed for winter-run Chinook salmon would be similar for steelhead.
41 However, as noted for Alternative 1A, juvenile steelhead migrants are typically older and larger than
42 Chinook salmon migrants, making them less susceptible to effects from restoration construction
43 activities. As larger migrants, steelhead pass through the river more quickly, resulting in lower risks

1 of exposure to increased turbidity, methylmercury, accidental spills, disturbed contaminated
2 sediments, or predation.

3 The following impacts are those presented under Alternative 4A and Alternative 1A that are
4 anticipated to be similar in nature for Alternative 4A, but would occur to a lesser extent because of
5 the reduced extent of the restoration measures under Alternative 4A.

6 Impact AQUA-97: Effects of Construction of Restoration Measures on Steelhead

7 The effects of construction of restoration measures on steelhead under Alternative 4A are similar in
8 nature to those discussed in more detail under Alternative 1A: temporary increases in turbidity;
9 increased exposure to mercury and methylmercury; accidental spills; disturbance of contaminated
10 sediments; in-water work activities; and predation. In-water and shoreline restoration construction
11 activities may result in short-term effects on steelhead through direct disturbance, short-term water
12 quality impacts, and increased exposure to contaminants associated with the incidental disturbance
13 of contaminated sediments. Overall and as noted for Alternative 1A, the effect of restoration
14 construction activities on the bioavailability of contaminants is expected to be minimal, as they
15 would likely be localized, sporadic, and of low magnitude. Implementation of the environmental
16 commitments described in Appendix 3B, *Environmental Commitments*, would minimize or eliminate
17 effects on steelhead. The relevant environmental commitments are: *Environmental Training*;
18 *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials*
19 *Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan*; and *Disposal of Spoils,*
20 *Reusable Tunnel Material, and Dredged Material*. Pertinent details of these plans are provided under
21 Impact AQUA-1 for delta smelt under Alternative 1A. Given the greatly reduced extent of restoration
22 under Alternative 4A relative to Alternative 1A, the effects of construction of restoration measures
23 on steelhead would be expected to be less than for Alternative 1A.

24 *NEPA Effects:* The effects of short-term construction activities would not be adverse to winter-run
25 Chinook salmon. Implementation of the environmental commitments described in Appendix 3B,
26 *Environmental Commitments*, would minimize or eliminate effects on steelhead. The relevant
27 environmental commitments are: *Environmental Training*; *Stormwater Pollution Prevention Plan*;
28 *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention,*
29 *Containment, and Countermeasure Plan*; and *Disposal of Spoils, Reusable Tunnel Material, and*
30 *Dredged Material*. Pertinent details of these plans are provided under Impact AQUA-1.

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

38 Impact AQUA-98: Effects of Contaminants Associated with Restoration Measures on Steelhead

39 As also noted for winter-run Chinook salmon, Alternative 4A habitat restoration actions could result
40 in the disturbance or mobilization of upland and aquatic contaminants that could affect steelhead.
41 As noted above, steelhead tend to pass through the Delta more quickly than other salmonids such as
42 winter-run Chinook salmon, so that any overlap with contaminant effects of restoration measures
43 would be limited. A detailed analysis of the potential effects based on the larger extent of tidal

1 habitat restoration proposed under Alternative 4A can be found in the *BDCP Effects Analysis –*
2 *Appendix 5D, Contaminants (hereby incorporated by reference)*. Potential impacts on steelhead from
3 effects of methylmercury, selenium, copper, ammonia, and pesticides associated with habitat
4 restoration activities would be similar to those discussed for delta smelt (see Impact AQUA-8).
5 Within the relatively small extent of habitat restored under *Environmental Commitment 4 Tidal*
6 *Natural Communities Restoration*, it is anticipated that any potential effects of methylmercury on
7 steelhead will be addressed through implementation of Environmental Commitment 12.
8 Environmental Commitment 12 is intended to minimize methylmercury exposure associated with
9 restoration measures for juvenile Chinook salmon. Additional analysis and tools may be developed
10 to further reduce methylmercury exposure as the habitat restoration conservation measures are
11 refined and analyzed in site-specific documents.

12 *NEPA Effects:* The effect of restoration measures on chemical contaminants is not adverse to
13 steelhead with respect to selenium, copper, ammonia, pesticides, and methylmercury (with
14 implementation of Environmental Commitment 12).

15 *CEQA Conclusion:* Alternative 4A restoration actions are likely to result in slightly increased
16 production, mobilization, and bioavailability of methylmercury. However, implementation of
17 *Environmental Commitment 12 Methylmercury Management* would help to minimize the increased
18 mobilization of methylmercury from restoration areas. Therefore, the impact of contaminants is
19 considered less than significant because it would not substantially affect steelhead either directly or
20 through habitat modifications. Consequently, no mitigation would be required.

21 Impact AQUA-99: Effects of Restored Habitat Conditions on Steelhead

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

26 *NEPA Effects:* The effects of restored habitat conditions on steelhead would not be adverse because
27 they would provide potentially suitable habitat for steelhead.

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

32 Other Environmental Commitments (Environmental Commitment 12, Environmental Commitment 33 15, and Environmental Commitment 16)

34 As noted for winter-run Chinook salmon, Alternative 4A includes three other Environmental
35 Commitments, which are reduced in their extent relative to the Conservation Measures included in
36 other Alternatives (e.g., Alternative 1A and Alternative 4). While the extent of these measures is
37 reduced compared to these alternatives, the nature of the mechanisms for steelhead remains the
38 same.

1 Impact AQUA-100: Effects of Methylmercury Management on Steelhead (Environmental
2 Commitment 12)

3 The impact discussion for winter-run Chinook salmon (Impact AQUA-46) is also applicable to
4 steelhead.

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

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

12 Impact AQUA-103: Effects of Localized Reduction of Predatory Fish on Steelhead
13 (Environmental Commitment 15)

14 *Environmental Commitment 15 Localized Reduction of Predatory Fish* would involve efforts to reduce
15 predation by predatory fish at the proposed north Delta intakes and at the south Delta export
16 facilities, including Clifton Court Forebay.

17 *NEPA Effects:* To the extent that localized predator control efforts of *Environmental Commitment 15*
18 *Localized Reduction of Predatory Fish* reduce the local abundance of fish predators at the north Delta
19 diversions and near the south Delta export facilities (e.g., in Clifton Court Forebay), it is possible, but
20 not assured, that there would be some reduction in losses to predation of juvenile steelhead
21 (predation of adults is not a concern). This is of relevance given the potential effects on steelhead
22 juveniles because of operations of the NDD (see Impact AQUA-93). Due to the uncertainty in the
23 effectiveness of Environmental Commitment 15, there would be no demonstrable effect of this
24 conservation measure on steelhead.

25 *CEQA Conclusion:* Due to the uncertainties associated with this Environmental Commitment, there
26 would be no demonstrable effect on steelhead. This impact is considered less than significant.
27 Consequently, no mitigation would be required.

28 Impact AQUA-104: Effects of Nonphysical Fish Barriers on Steelhead (Environmental
29 Commitment 16)

30 As noted for winter-run Chinook salmon, under Alternative 4A, an NPB at the divergence of
31 Georgiana Slough from the Sacramento River would be intended to guide juvenile salmonid fish such
32 as steelhead away from Georgiana Slough and the interior Delta, wherein survival is relatively low
33 compared to the Sacramento River (Singer et al. 2013). As noted for spring-run Chinook salmon,
34 exploration with the DPM of the potential effects of an NPB at this location suggests that with
35 effectiveness similar to that observed during a pilot study in 2011 (Perry et al. 2012), through-Delta
36 survival of juvenile Chinook salmon would not differ greatly between Alternative 4A and Existing
37 Conditions or NAA_ELT (see Table 5.C.5.3-41 in the *BDCP Effects Analysis Appendix 5.C hereby*
38 *incorporated by reference*). These results, which are assumed to also be applicable to steelhead given
39 similar life histories, suggest that Environmental Commitment 16 could offset negative effects of the
40 water conveyance facilities. As discussed for Alternative 1A, the physical structure of an NPB may
41 provide habitat for piscivorous fish in the area and increase localized predation risk.

1 *NEPA Effects:* The effects of NPB would not be adverse because it is intended to improve migration
2 survival.

3 *CEQA Conclusion:* As discussed above, the NPB at the divergence of Georgiana Slough from the
4 Sacramento River has the potential to reduce the proportion of steelhead entering the low-survival
5 interior Delta. The impacts of *Environmental Commitment 16 Nonphysical Fish Barriers* are expected
6 to be less than significant. Consequently, no mitigation would be required.

7 Sacramento Splittail

8 Construction and Maintenance of Water Conveyance Facilities

9 The discussion of potential effects to delta smelt from construction and maintenance of the water
10 conveyance facilities under Alternative 4A is also relevant to Sacramento splittail. As discussed for
11 Alternative 1A, various life stages of Sacramento splittail would have the potential to overlap
12 construction and maintenance to varying degrees (Table 11-8).

13 Impact AQUA-109: Effects of Construction of Water Conveyance Facilities on Sacramento 14 Splittail

15 The potential effects of construction of the water conveyance facilities on Sacramento splittail would
16 be the same as described for Alternative 4 (Impact AQUA-109). This section provides additional
17 detail on underwater noise impacts which are also applicable to Impact AQUA-109 in Alternative 4.

18 Table 11-8 presents the life stages of Sacramento splittail and the months of their potential presence
19 in the north, east, and south Delta during the proposed in-water construction window (June 1–
20 October 31). Under Alternative 4A, underwater noise generated by impact pile driving in or near
21 open waters of the Delta can reach levels associated with potential injury of fish, including
22 Sacramento splittail. The potential exists for relatively large numbers of young-of-the-year to occur
23 in the vicinity of pile driving activities at the north Delta intakes, barge unloading facilities, Clifton
24 Court Forebay, and Head of Old River operable barrier as larvae and juveniles disperse from
25 upstream spawning and early rearing areas (riparian margins and floodplains) to the estuary in
26 April-August. However, because of the relatively small area of open water affected by noise
27 exceeding the injury thresholds (Table 4.3.7-1 under Delta Smelt), the limited duration of pile
28 driving activities (Table 4.3.7-1 under Delta Smelt), and the lack of suitable rearing habitat in the
29 affected areas, adverse effects would be limited to a small proportion of the population.

30 Implementation of Mitigation Measures AQUA-1a and AQUA-1b would further reduce these impacts.
31 No significant population-level effects are expected.

32 *NEPA Effects:* As concluded for Alternative 4, Impact AQUA-109, the effect would not be adverse for
33 Sacramento splittail. Implementation of the measures described in Appendix 3B, *Environmental*
34 *Commitments*, such as *Environmental Training; Stormwater Pollution Prevention Plan; Erosion and*
35 *Sediment Control Plan; Hazardous Materials Management Plan; Spill Prevention, Containment, and*
36 *Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material; Fish Rescue*
37 *and Salvage Plan; and Barge Operations Plan* would guide rapid and effective response in the case of
38 inadvertent spills of hazardous materials. Construction would not be expected to increase predation
39 rates relative to baseline conditions. Construction will result in both temporary and permanent
40 alteration of rearing and migratory habitats used by splittail. However, Alternative 4A includes
41 Environmental Commitment 4 to restore tidal habitat and Environmental Commitment 6 to restore
42 channel margin habitat. Underwater noise produced by impact pile driving could result in adverse