Appendix 11K Weighted Usable Area Analysis

Appendix 11K Weighted Usable Area Analysis

11K.1 Introduction

Weighted usable area (WUA) analysis provides estimates of the amount of suitable spawning and rearing habitat of fishes available in rivers and streams at various levels of flow. WUA is computed as the surface area of physical habitat available weighted by its suitability. Habitat suitability is determined from field studies of the distributions of redds or rearing juveniles with respect to flow velocities, depths, and substrate or cover characteristics in the river. These data are used in model simulations (PHABSIM) that estimate the availability of suitable habitat in a portion of the river at a given flow. WUA curves showing suitable habitat availability versus flow are generated from the simulations.

For this RDEIR/SDEIS, spawning WUA was estimated for winter-run, spring-run, fall-run, and late fall–run Chinook salmon and California Central Valley steelhead in the Sacramento, Feather and American Rivers. Fry and juvenile rearing WUA were estimated only for the Sacramento River because no acceptable rearing WUA curves are available for the Feather and American Rivers. Spawning and rearing WUA was estimated for the No Action Alternative (NAA) and Alternatives 1A, 1B, 2, and 3 (hereinafter referred to as Alternatives 1–3) from CALSIM II flow data for each month of the 82-year period of record.

11K.2 Methods

11K.2.1. Spawning Habitat Weighted Usable Area

11K.2.1.1. Sacramento River

The WUA curves used for Chinook salmon and steelhead spawning habitat in the Sacramento River were obtained from two U.S. Fish and Wildlife Service (USFWS) reports (U.S. Fish and Wildlife Service 2003a, 2006). Modeling assumptions used to derive spawning WUA curves include that the suitability of physical habitat for salmon and steelhead spawning is largely a function of substrate particle size, water depth, and flow velocity. The race- or species-specific suitability of the habitat with respect to these variables is determined by cataloguing conditions at active redds and is used to develop habitat suitability criteria (HSC) for each race or species of fish. Hydraulic modeling is then used to estimate the amount of habitat available for different HSC levels at different river flows, and the results are used to develop spawning habitat WUA curves (Bovee et al. 1998). The WUA curves and tables are used to look up the amount of spawning WUA available at different flows during the spawning periods of the race or species.

USFWS (2003a) provides WUA curves and tables for spawning winter-run, fall-run, and late fall–run Chinook salmon and steelhead for three segments of the Sacramento River encompassing the reach from Keswick Dam to Battle Creek (Figure 11K-1). The WUA tables

were updated in 2006 (U.S. Fish and Wildlife Service 2006). No WUA curves were developed for spring-run Chinook salmon, but as discussed later, the fall-run curves were used to quantify spring-run spawning habitat. Also as further discussed below, the HSC used to develop the steelhead WUA curve for Sacramento River spawning were obtained from investigations of steelhead redds in the American River (U.S. Fish and Wildlife Service 2003b) because few steelhead redds were observed in the Sacramento River. Figure 11K-2 through Figure 11K-5 show the flow versus spawning WUA results for winter-run, fall-run, late fall–run and steelhead in the three river segments (Segment 6 = Keswick to Anderson-Cottonwood Irrigation District [ACID] Dam, Segment 5 = ACID Dam to Cow Creek, and Segment 4 = Cow Creek to Battle Creek) as provided by USFWS (2006). Figure 11K-6 shows spawning WUA results for fall-run in an additional downstream segment (Segment 3 = Battle Creek to Red Bluff Diversion Dam [RBDD]) because spawning for fall run occurs further downstream than it does for the other salmon runs. Note that for Segment 6, separate WUA curves were developed for periods when the ACID Dam boards were installed (April through October) and for when the boards were out because installation of the boards affects water depths and velocities for some of the sampling transects used to develop the curves.

Because several tributaries enter the Sacramento River between Keswick Dam and Battle Creek, flows generally differ among the segments. For the USFWS studies, Sacramento River flows were measured directly at the sampling transects and were estimated as the sum of Keswick Dam flow releases and tributary gauge readings upstream of the transects. To estimate WUA for the effects analysis, the segment flows were estimated using Sacramento River CALSIM II flows at Keswick Dam, the Clear Creek confluence, and Battle Creek. Keswick Dam flows were used for Segment 5 upstream of the Clear Creek confluence. For Segment 6, the WUA curves for the months when the ACID Dam boards are installed (April through October) were used with the Keswick Dam flows for those months and the WUA curves for the months when the ACID Dam boards are out were used with the flows for the rest of the year. To evaluate the relative importance of results from the three segments for each race or species in the effects analysis, the typical spawning distributions of the salmon with respect to the segments (Table 11K-1) was estimated from aerial redd surveys conducted by California Department of Fish and Wildlife (ICF 2016). All races other than fall-run primarily spawn upstream of the Battle Creek confluence, and most fall-run spawning occurs upstream of the RBDD. Little is known about steelhead spawning locations in the Sacramento River, although it was assumed for this analysis that, because of constraints on water temperature and other habitat features, individuals spawn between Keswick Dam and RBDD, where nearly all Chinook salmon spawn (Table 11K-1).

Table 11K-1. Distributions of Spawning Redds among WUA River Segments as Percent of Total in the Sacramento River for Chinook Salmon Runs.

Segment	Description	River Miles	Winter-run	Spring-run	Fall-run	Late fall–run
6	Keswick to ACID[a]	302-298.5	45.0%	12.4%	16.3%	67.6%
5	ACID to Cow Creek	298.5-280	54.6%	66.0%	25.9%	12.7%
4	Cow Creek to Battle Creek	280-271	0.4%	12.8%	18.4%	9.2%
3	Battle Creek to RBDD	271-243	0.0%	4.9%	22.8%	4.3%
—	Downstream of RBDD	—	0.0%	4.0%	16.6%	6.2%

[a] ACID = Anderson-Cottonwood Irrigation District

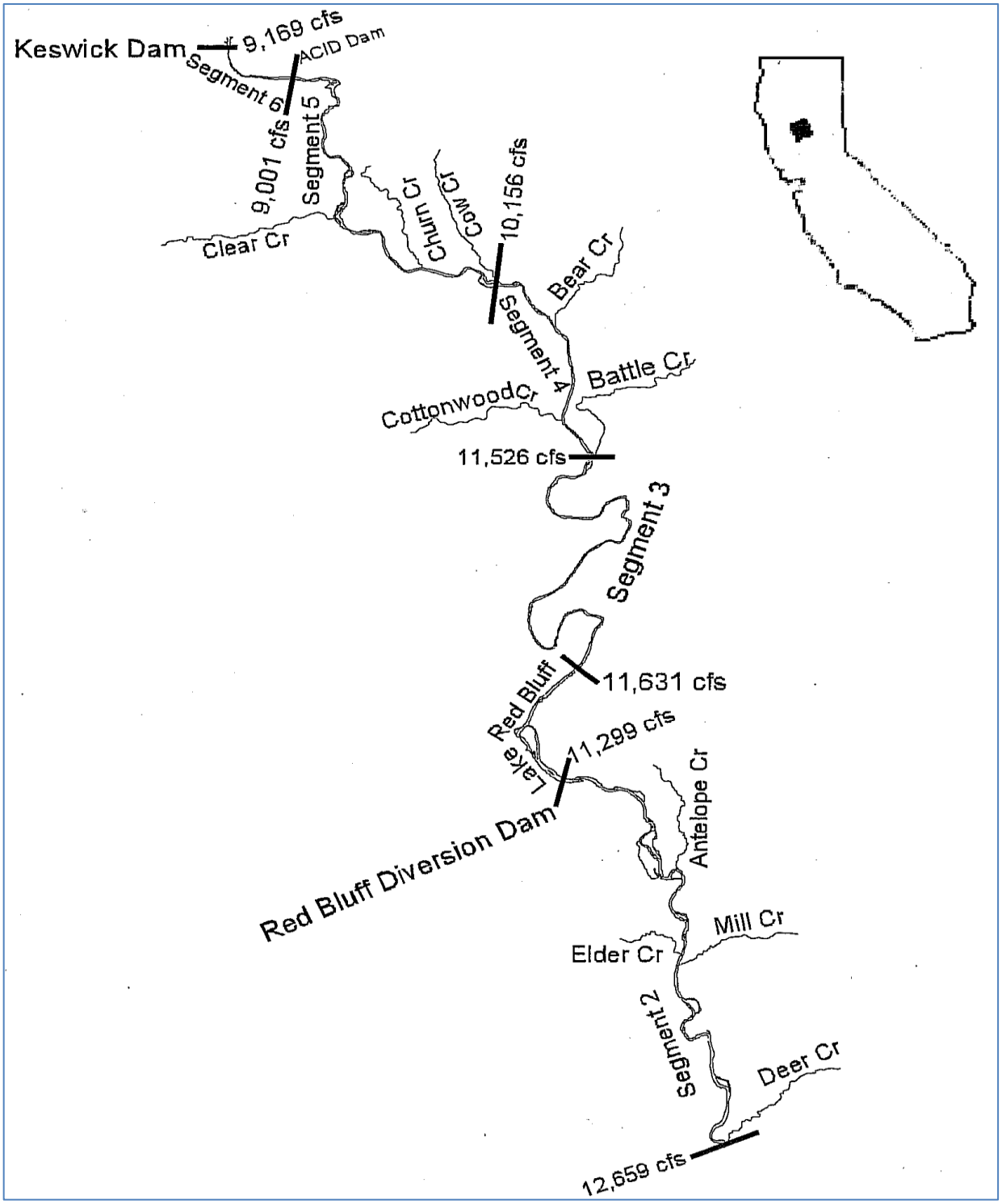

Figure 11K-1. Segments 2–6 of the Sacramento River Used in U.S. Fish and Wildlife Service Studies to Determine Spawning and Rearing Weighted Usable Area (WUA) (flows in the figure are the average flows at the upstream boundary of each segment for October 1974 to September 1993). Source: U.S. Fish and Wildlife Service 2003a.

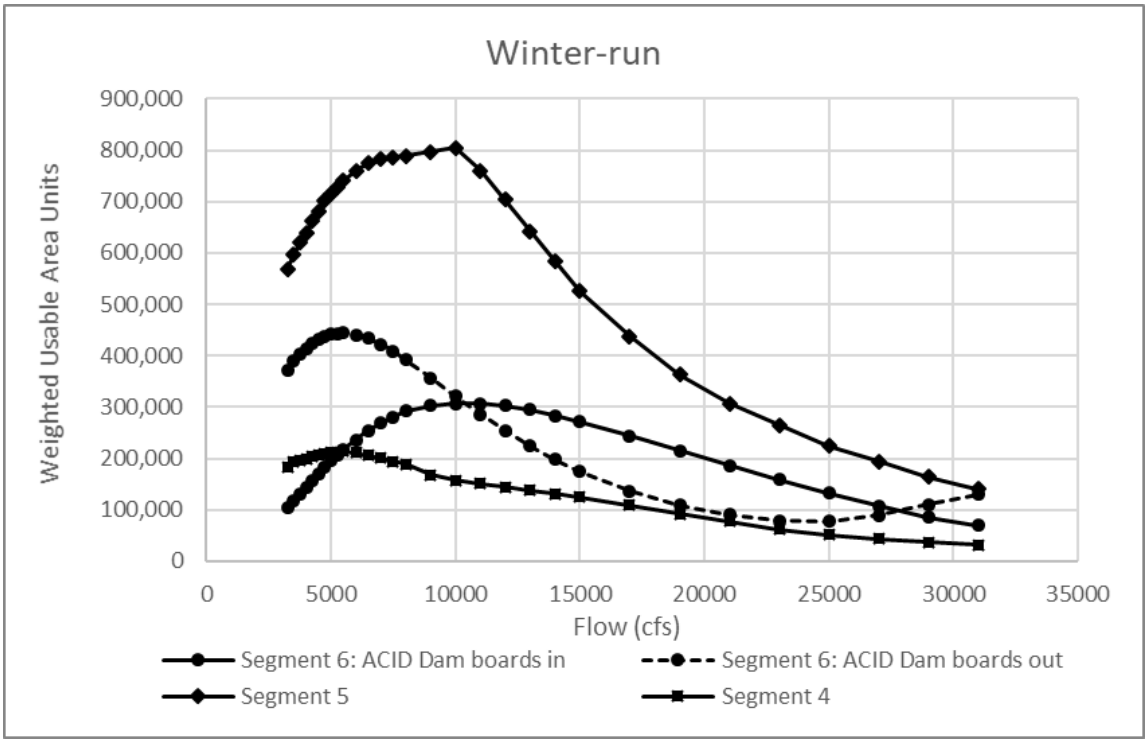

Figure 11K-2. Spawning WUA curves for Winter-Run Chinook Salmon in the Sacramento River, Segments 4 to 6. ACID = Anderson-Cottonwood Irrigation District.

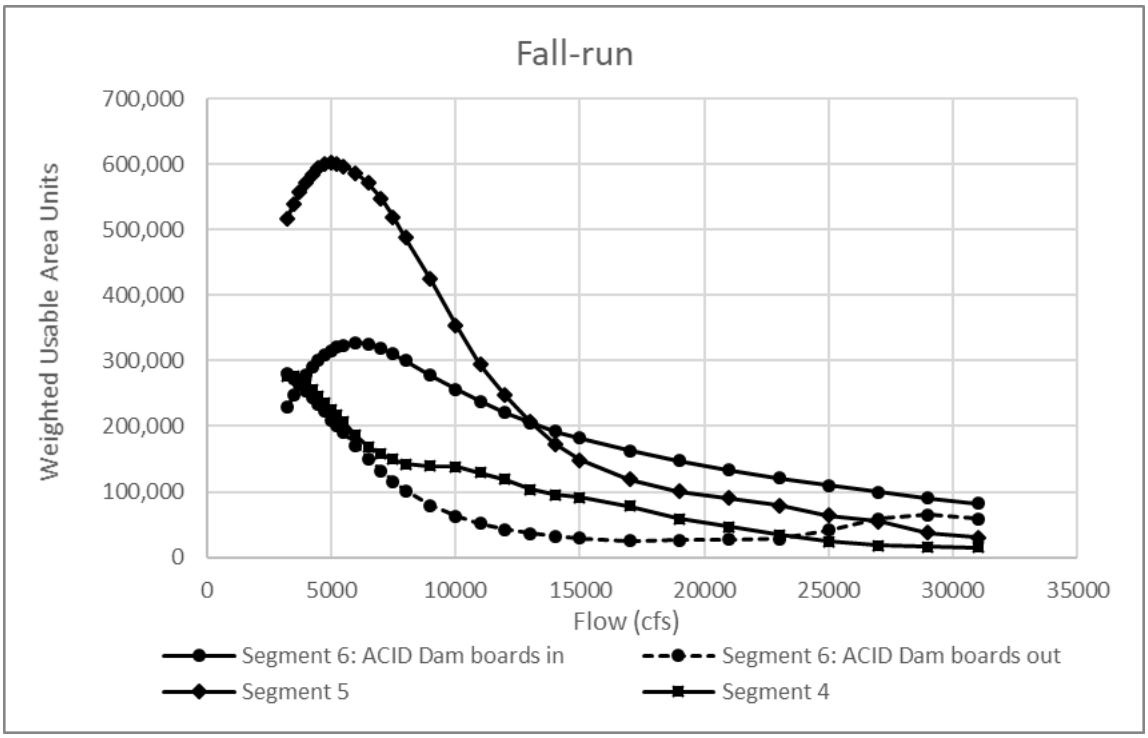

Figure 11K-3. Spawning WUA Curves for Fall-Run Chinook Salmon in the Sacramento River, Segments 4 to 6. The fall-run curves were also used to quantify spring-run Chinook salmon WUA, as discussed in the text. ACID = Anderson-Cottonwood Irrigation District.

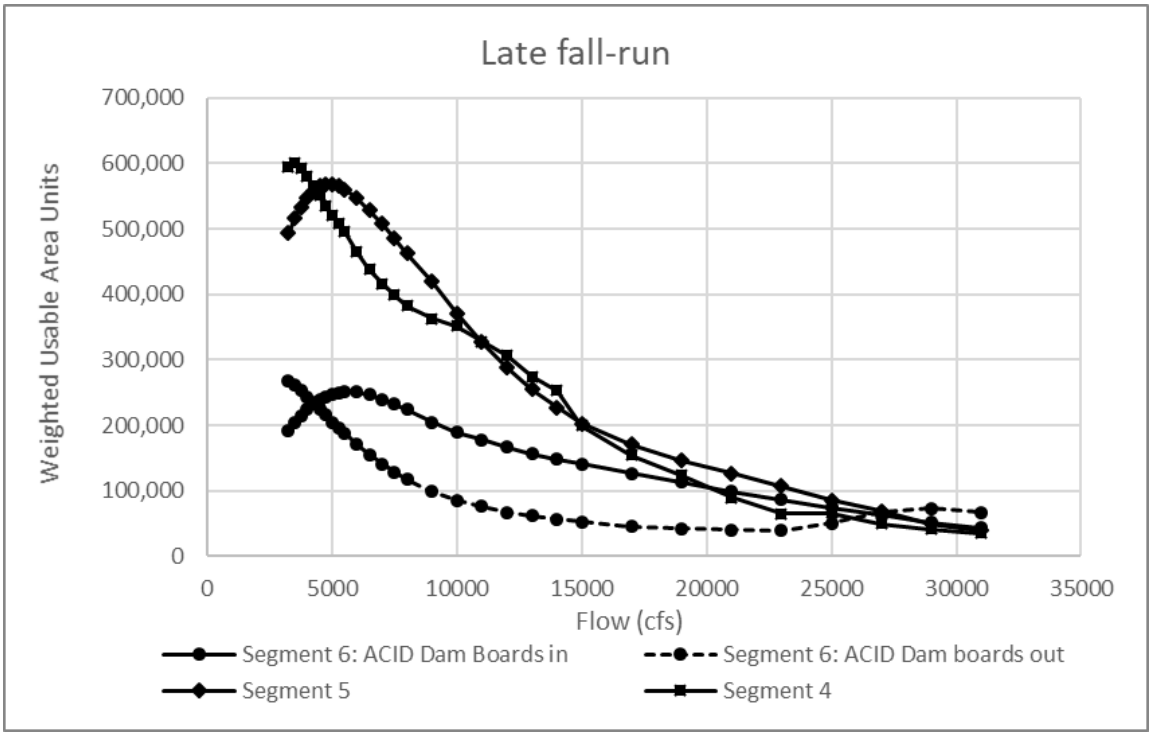

Figure 11K-4. Spawning WUA Curves for Late Fall–Run Chinook Salmon in the Sacramento River, Segments 4 to 6. ACID = Anderson-Cottonwood Irrigation District.

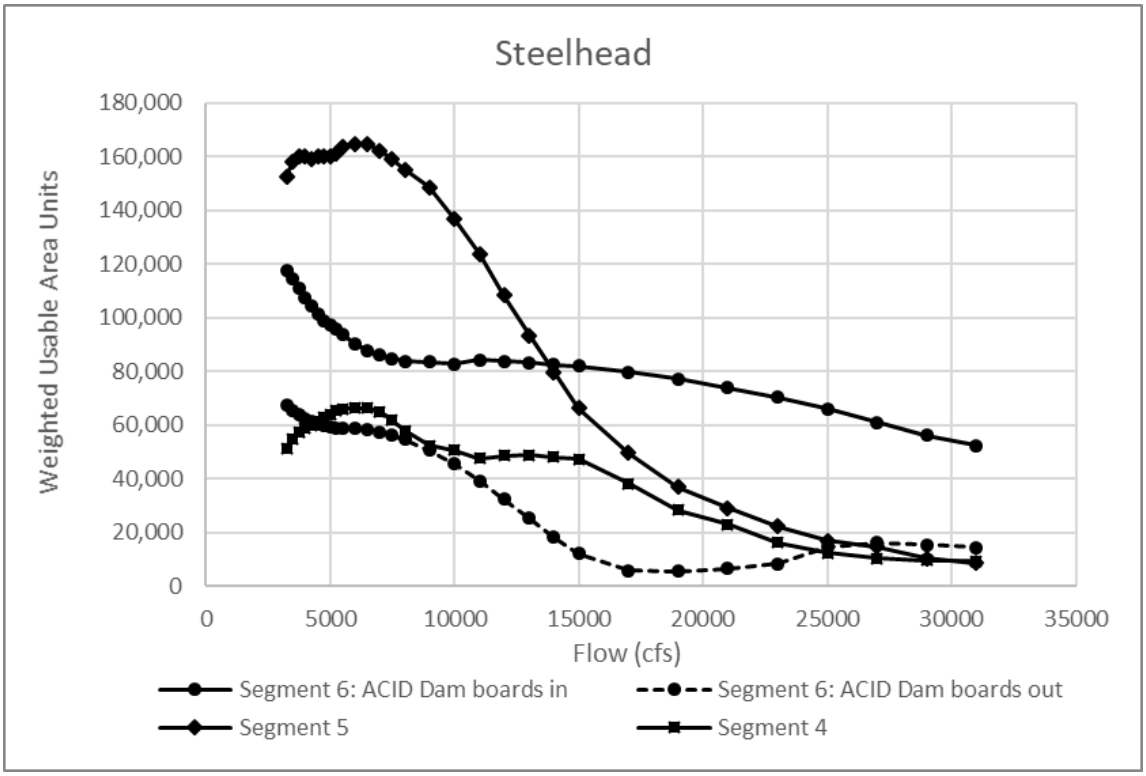

Figure 11K-5. Spawning WUA curves for Steelhead in the Sacramento River, Segments 4 to 6. ACID = Anderson-Cottonwood Irrigation District.

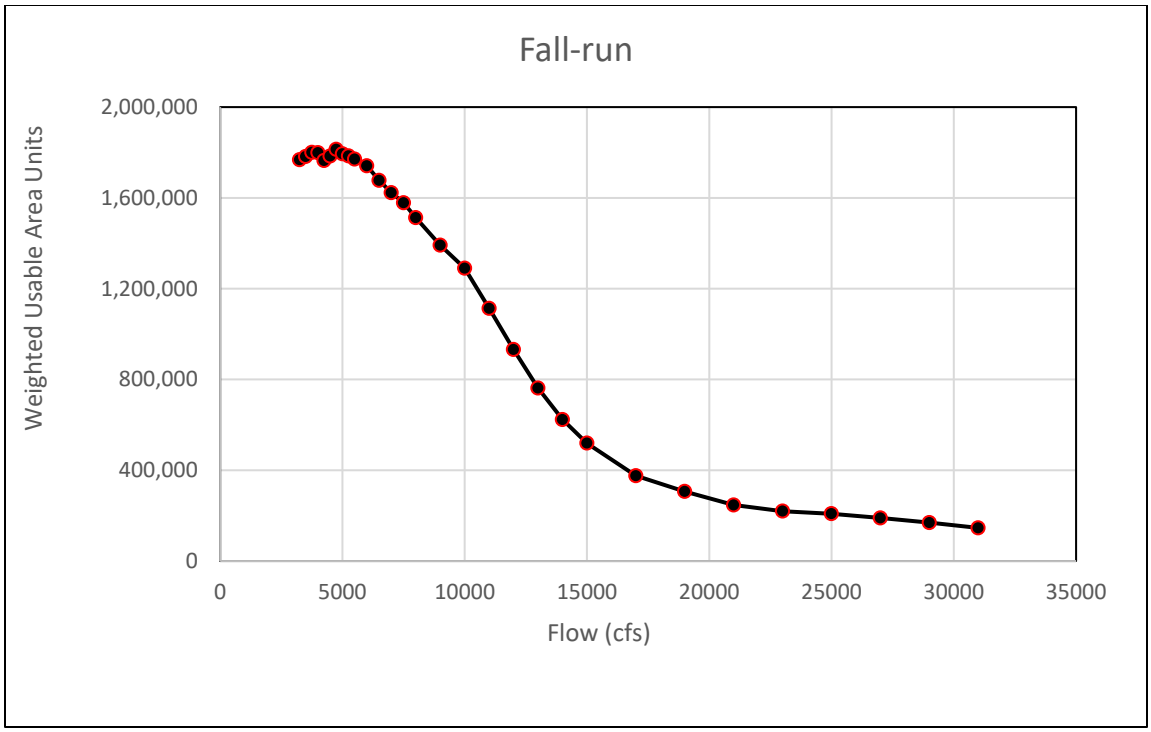

Figure 11K-6. Spawning WUA Curve for Fall–Run Chinook Salmon in the Sacramento River, Segment 3.

Because there are no spring-run Chinook salmon WUA curves in the USFWS documentation, the previous practice (described below) has been to use fall-run Chinook salmon WUA curves to model spring-run habitat. Two models that currently produce spawning WUA outputs for spring-run Chinook salmon, SALMOD and SacEFT (Sacramento River Ecological Flows Tool), derive the spring-run WUA results using the fall-run Chinook salmon spawning WUA curves as surrogates (Bartholow 2004; ESSA Technologies 2011). Mark Gard, who led the USFWS studies that produced the Sacramento River WUA curves, has endorsed this practice (Gard pers. comm.). However, this practice introduces uncertainty to the spring-run Chinook salmon results. Although fall-run spawning WUA curves were used as surrogates for spring-run spawning, CALSIM II flows for the months of spring-run spawning, not those of fall-run spawning, were used to compute the spring-run WUA results.

A potential limitation of the Sacramento River spawning WUA curves for steelhead is the use of previously obtained American River steelhead HSC used in developing the curves (U.S. Fish and Wildlife Service 2003b). HSC data were not collected by USFWS for steelhead in the Sacramento River because very few steelhead redds were observed and because the steelhead redds could not be distinguished from those of resident rainbow trout. The validity of this substitution could not be tested and is uncertain (U.S. Fish and Wildlife Service 2003a).

A further limitation of the WUA curves presented above, as of all such habitat-based studies, is that they assume the channel characteristics of the river during the time of field data collection by USFWS (1995–1999), such as proportions of mesohabitat types, have remained in dynamic equilibrium to the present time and would continue to do so through the life of the Project. If the channel characteristics substantially change, the shape of the curve may no longer be applicable.

Differences in the mean spawning WUA under Alternatives 1–3 and NAA were examined for the months of the spawning period under each water year type and all water year types combined. Differences in mean spawning WUA of greater than 5% were flagged in the results tables to highlight results with the largest differences.

11K.2.1.2. Feather River

The relationships between instream flows and Chinook salmon and steelhead spawning habitat availability (WUA) in the Feather River developed by Payne and Allen (2004) were used in this effects analysis to determine effects of changing flows on Chinook salmon (spring-run and fall-run) and steelhead spawning WUA in the lower Feather River (Figure 11K-7 and Figure 11K-8). Although spring-run, fall-run and steelhead spawn in both the upper Feather River between the Fish Barrier Dam and Thermalito Afterbay Outlet and the lower Feather River downstream of the Thermalito Afterbay Outlet, Alternatives 1–3 would have no effect on flow in the upper river (Low Flow Channel), so differences in WUA between Alternatives 1–3 and the NAA were estimated only for the lower river (High Flow Channel).

Differences in the mean spawning WUA under Alternatives 1–3 and the NAA and were examined for the months of the spawning period for each species and race under each water year type and all water year types combined. Differences in mean spawning WUA of greater than 5% were flagged in the results tables to highlight the largest differences.

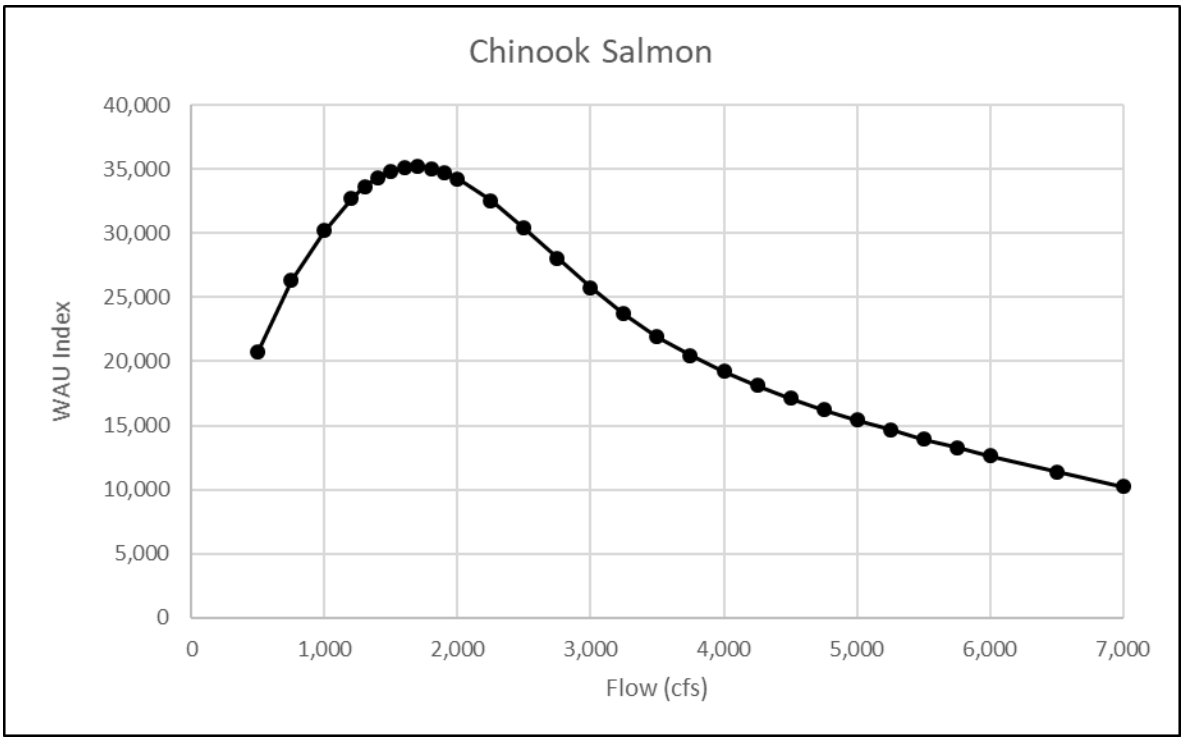

Figure 11K-7. Spawning WUA for Chinook Salmon (spring-run and fall-run) in the Feather River below Thermalito Afterbay Outlet.

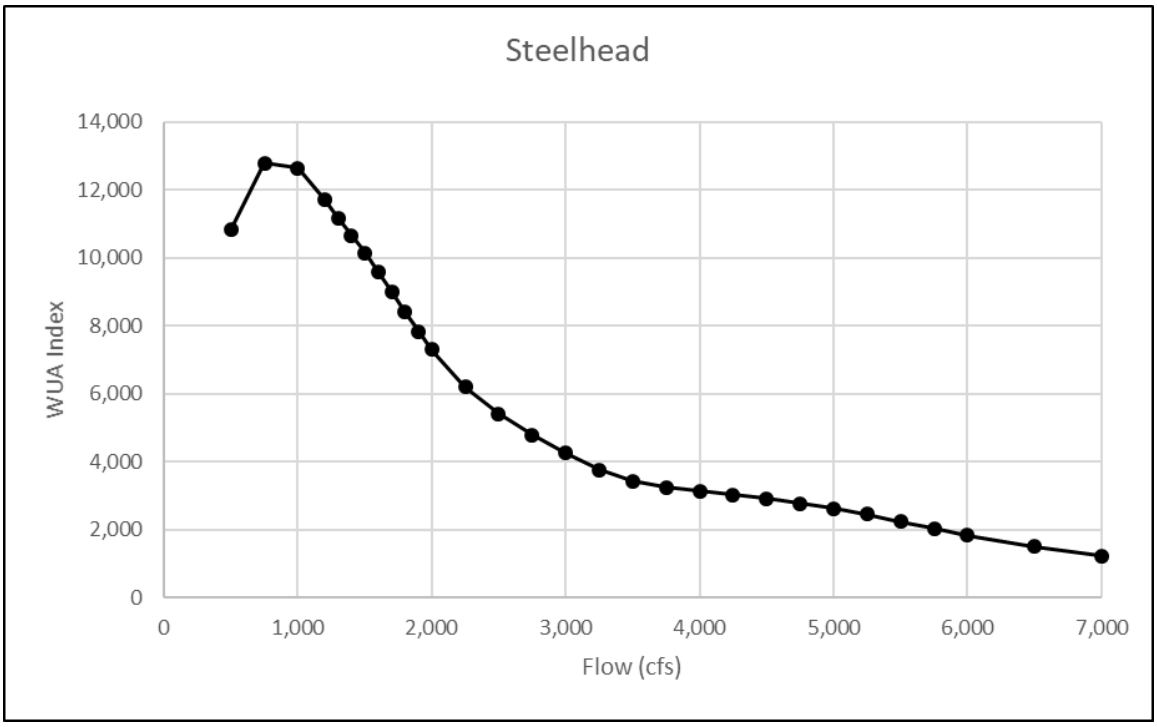

Figure 11K-8. Spawning WUA for California Central Valley Steelhead in the Feather River below Thermalito Afterbay Outlet.

11K.2.1.3. American River

The WUA curves used for fall-run Chinook salmon and steelhead spawning habitat in the American River were obtained from Bratovich et al. (2017), which provides spawning WUA curves for fall-run and steelhead in eight reaches of the American River. The eight reaches lie within the approximately 10-mile river reach from Nimbus Dam downstream to Riverbend Side Channel, where most salmon and steelhead spawning occurs. Figure 11K-9 and Figure 11K-10 show composite WUA curves for flow versus spawning that combine the WUA results for the eight reaches. For this effects analysis, CALSIM II flows at Nimbus Dam were used to compute fall-run and steelhead spawning WUA from the composite WUA curves and tables.

Differences in the mean spawning WUA under Alternatives 1–3 and the NAA were examined for the months of the spawning period under each water year type and all water year types combined. Differences in mean spawning WUA of greater than 5% were flagged in the results tables to highlight results with the largest differences.

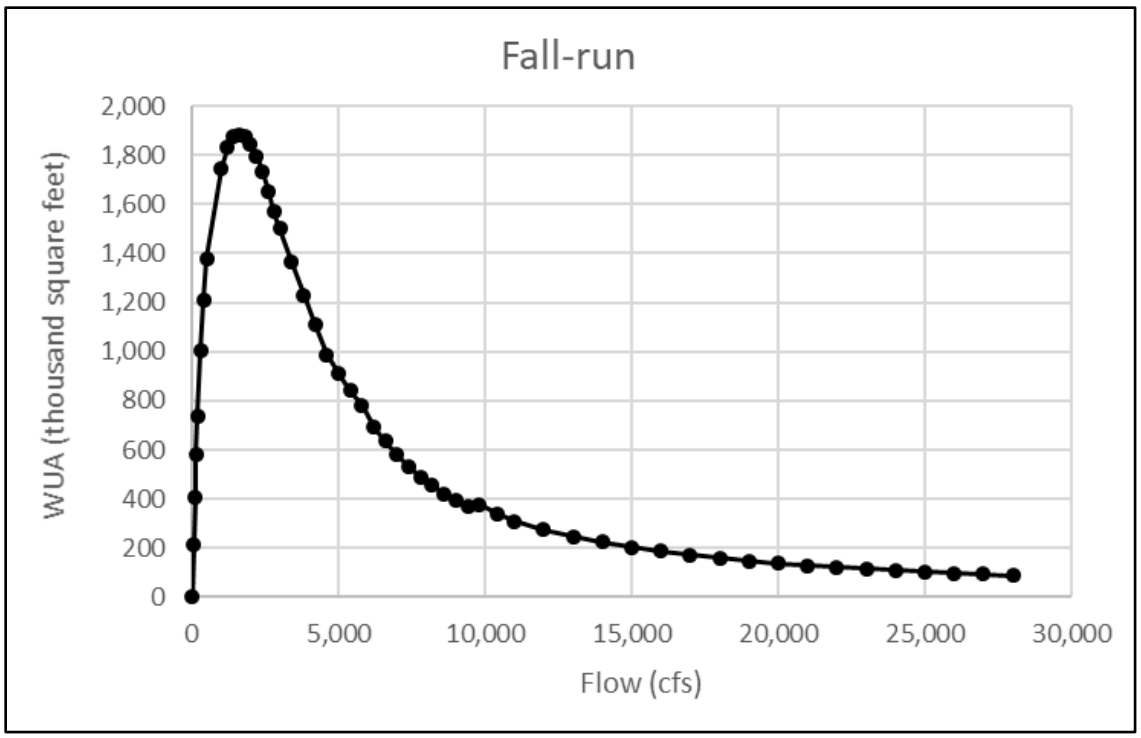

Figure 11K-9. Composite Spawning WUA for Fall-Run Chinook Salmon in the American River.

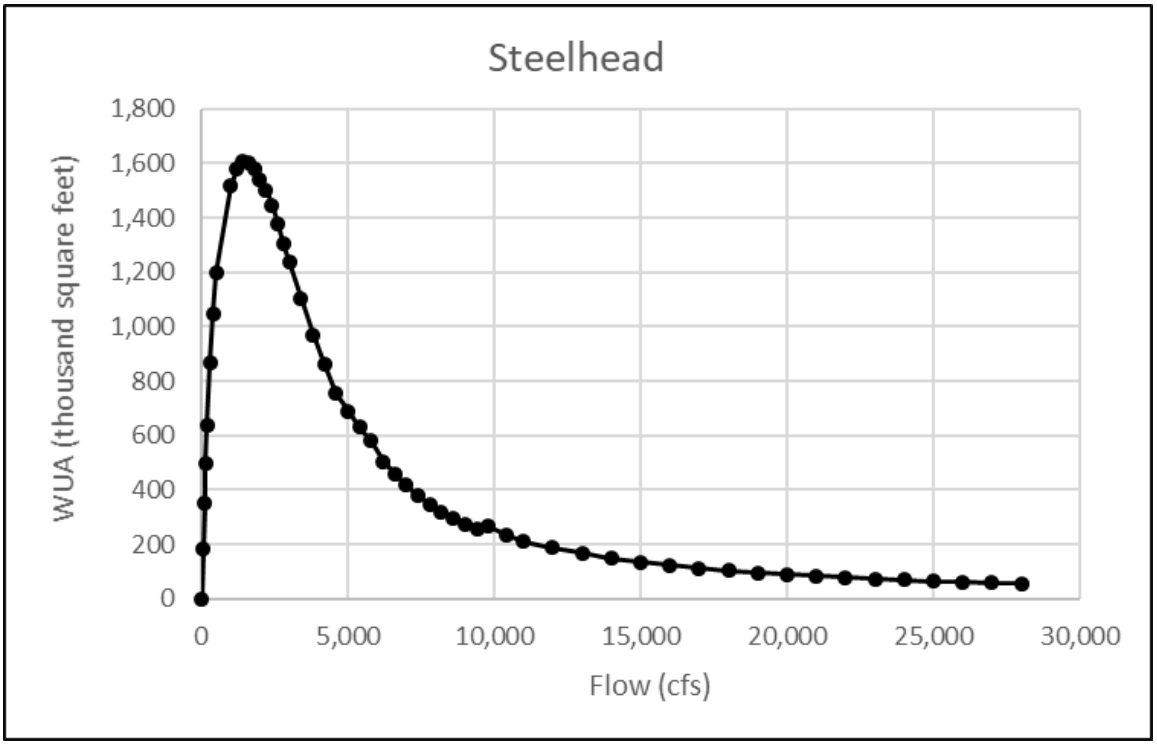

Figure 11K-10. Composite Spawning WUA for Steelhead in the American River.

11K.2.2. Rearing Habitat Weighted Usable Area

The availability of rearing habitat was estimated using WUA curves obtained from the literature (U.S. Fish and Wildlife Service 2005b). WUA is an index of the surface area of physical habitat available, weighted by the suitability of that habitat. WUA curves are normally developed as part of instream flow incremental methodology studies. Rearing habitat WUA was estimated only for the Sacramento River because no adequate flow versus rearing WUA curves located for the Feather or American River were available. The available flow versus rearing WUA information for these rivers is old, limited, and potentially unreliable (U.S. Fish and Wildlife Service 1985; Thomas R. Payne & Associates 2002).

11K.2.2.1. Sacramento River

The rearing habitat WUA curves used for Chinook salmon rearing habitat in the Sacramento River were obtained from a USFWS report (U.S. Fish and Wildlife Service 2005b). As noted above for spawning habitat, WUA is computed as the surface area of physical habitat available weighted by its suitability. Modeling assumptions used to derive rearing WUA curves include that the suitability of physical habitat for salmon and steelhead rearing is largely a function of water depth, flow velocity, and the availability and type of cover. The race- or species-specific suitability of the habitat with respect to these variables is determined by observing the fish and is used to develop HSC for each race or species. Hydraulic modeling is then used to estimate the amount of rearing habitat available for different HSC levels at different river flows, and the results are used to develop rearing habitat WUA curves and tables (Bovee et al. 1998). These curves and tables are used to look up the amount of rearing WUA available at different flows.

USFWS (2005b) provides WUA curves and tables for rearing winter-run, fall-run, and late fall–run Chinook salmon for three segments of the Sacramento River encompassing the reach from Keswick Dam to Battle Creek (Figure 11K-1). Separate curves were developed for fry and juveniles, with fry defined as fish less than 60 millimeters and juveniles defined as greater than 60 millimeters. No WUA curves were developed for spring-run Chinook salmon or steelhead, but as discussed later, the fall-run curves were used to quantify spring-run rearing habitat and the late fall–run curves were used for steelhead. Figure 11K-11 through Figure 11K-16 show the flow versus rearing WUA results for fry and juvenile winter-run, fall-run, and late fall–run Chinook salmon in the three river segments (Segment 6 = Keswick to ACID Dam, Segment 5 = ACID Dam to Cow Creek, and Segment 4 = Cow Creek to Battle Creek) as provided in USFWS (2006). Note that for Segment 6, separate WUA curves were developed for periods when the ACID Dam boards are installed (April through October) and for when the boards are out because installation of the boards affects water depths and velocities for some of the sampling transects used to develop the curves. All rearing WUA analyses were limited to juveniles less than a year old.

Because tributaries enter the Sacramento River between Keswick Dam and Battle Creek, flows are generally different among the three segments. For the USFWS studies, flows were measured directly at the sampling transects and were estimated as the sum of Keswick flow releases and tributary gage readings upstream of the transects. To estimate WUA for the effects analysis, the segment flows were estimated using Sacramento River CALSIM II flows at Keswick Dam, the Clear Creek confluence, and Battle Creek for Segments 6, 5, and 4, respectively. Keswick Dam flows were used for Segment 5 upstream of the Clear Creek confluence. For Segment 6, the

WUA curves for the months when the ACID Dam boards are installed (April through October) were used with the flows for those months and the WUA curves for the months when the ACID Dam boards are out were used with the flows for the rest of the year.

Although fall-run rearing WUA curves were used as surrogates for spring-run rearing, CALSIM II flows for the months of spring-run rearing, not those of fall-run rearing, were used to compute the spring-run WUA results. This caveat applies as well to the use of the late fall–run rearing WUA curves to compute steelhead WUA results.

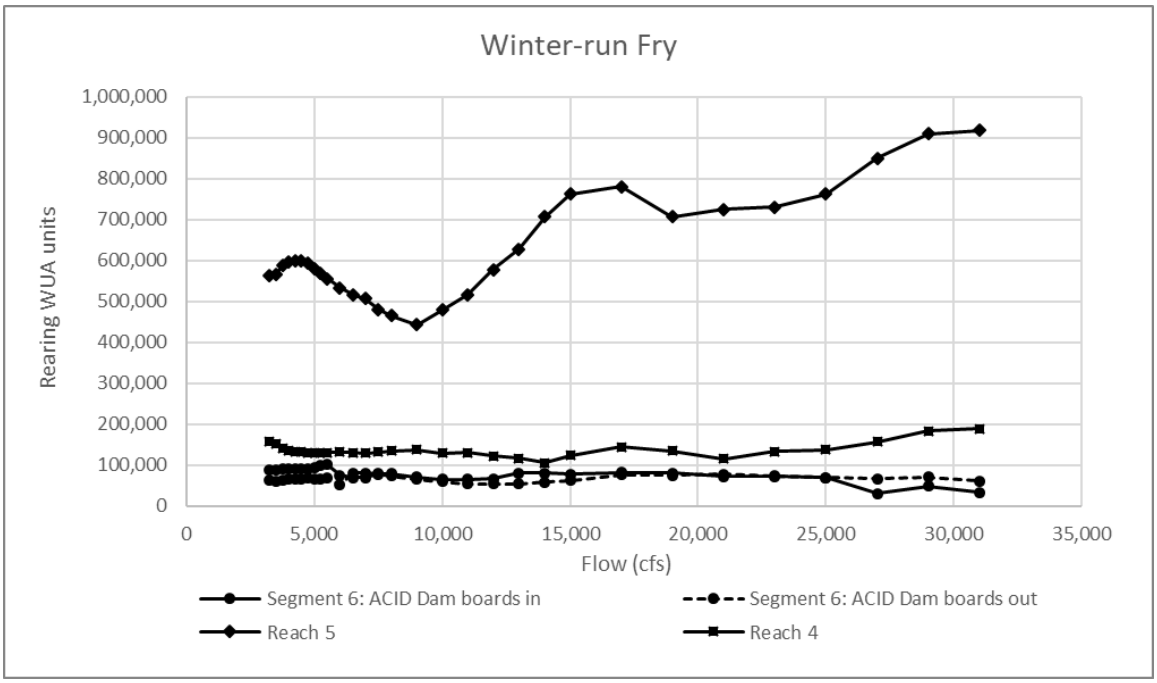

Figure 11K-11. Rearing WUA curves for Winter-Run Chinook Salmon Fry in the Sacramento River, Segments 4 to 6. ACID = Anderson-Cottonwood Irrigation District.

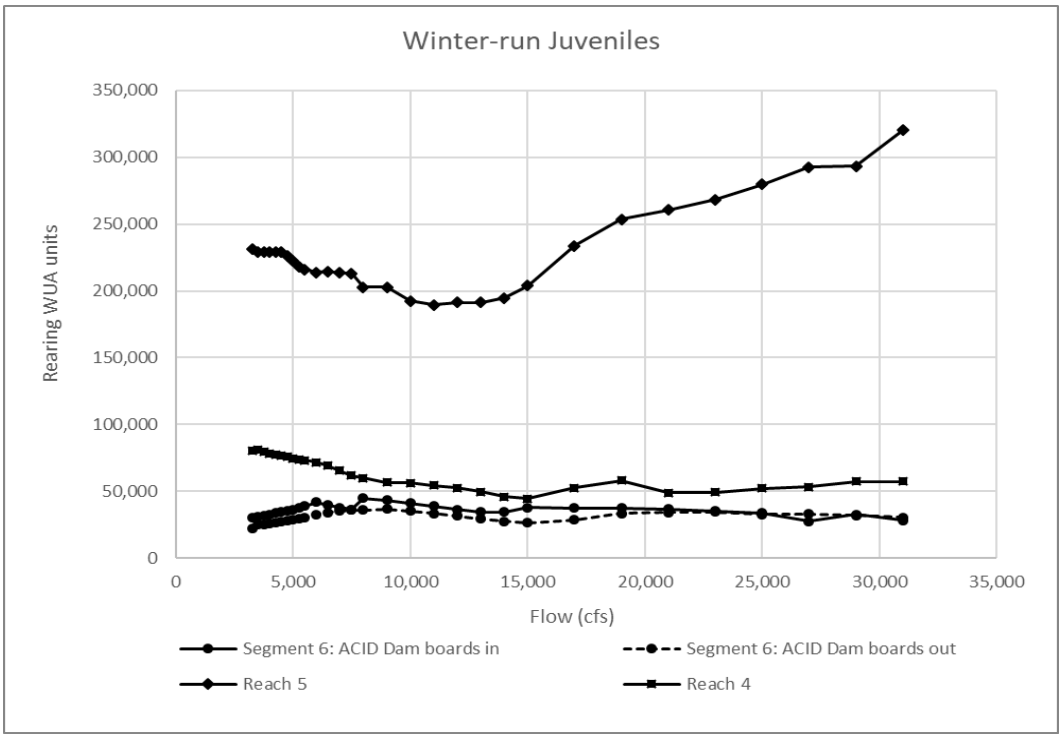

Figure 11K-12. Rearing WUA curves for Winter-Run Chinook Salmon Juveniles in the Sacramento River, Segments 4 to 6. ACID = Anderson-Cottonwood Irrigation District.

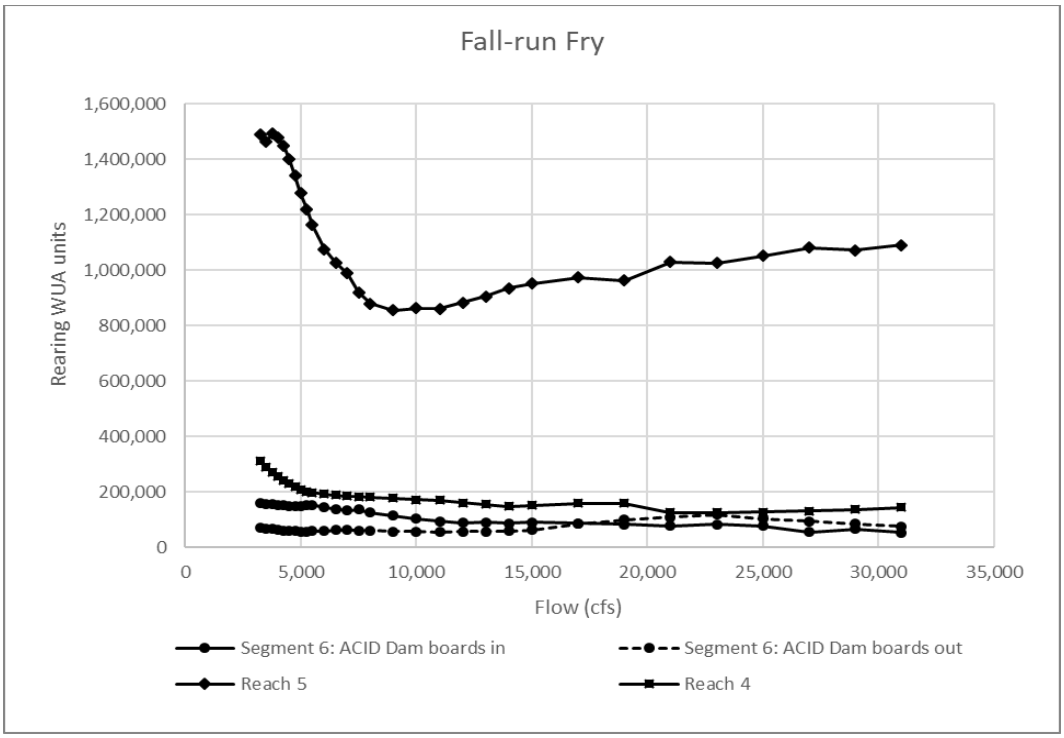

Figure 11K-13. Rearing WUA Curves for Fall-Run Chinook Salmon Fry in the Sacramento River, Segments 4 to 6. (The fall-run curves were used to quantify spring-run Chinook salmon WUA, as discussed in the text.) ACID = Anderson-Cottonwood Irrigation District.

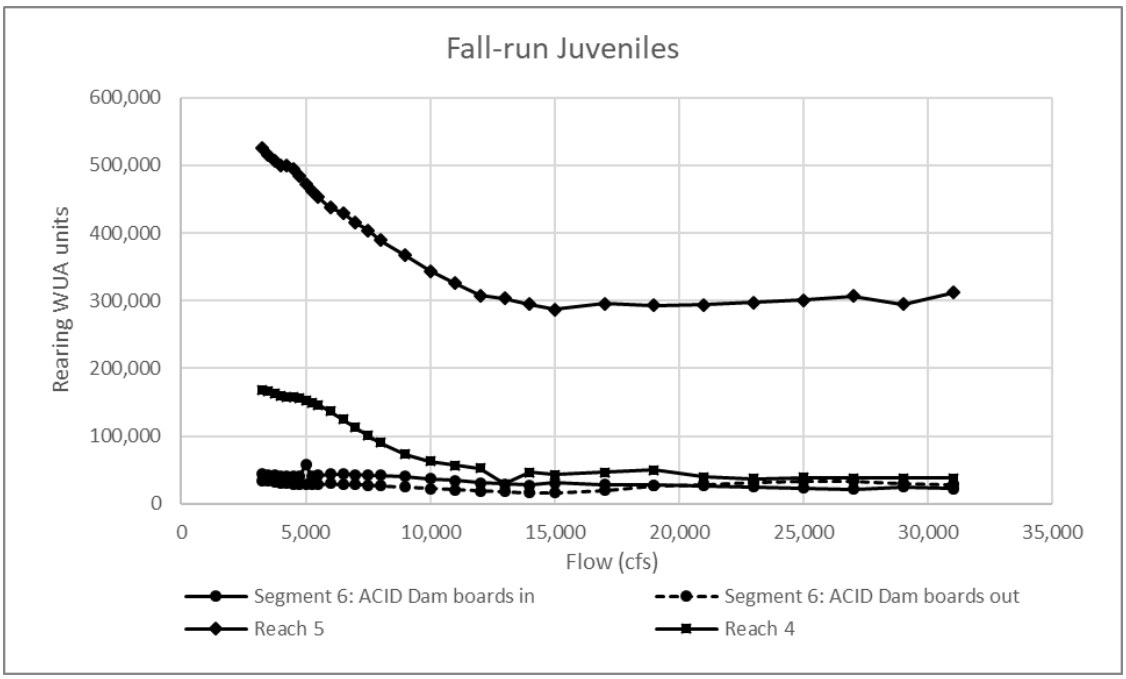

Figure 11K-14. Rearing WUA Curves for Fall-Run Chinook Salmon Juveniles in the Sacramento River, Segments 4 to 6. (The fall-run curves were used to quantify spring-run Chinook salmon WUA, as discussed in the text.) ACID = Anderson-Cottonwood Irrigation District.

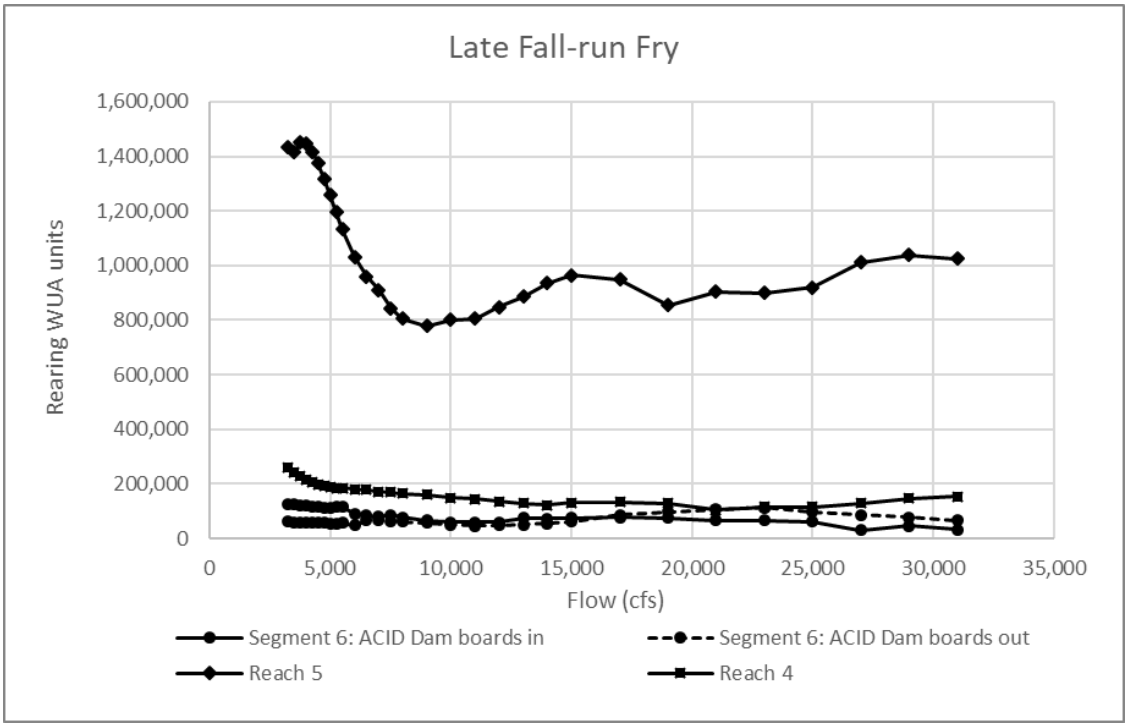

Figure 11K-15. Rearing WUA Curves for Late Fall–Run Chinook Salmon Fry in the Sacramento River, Segments 4 to 6. (The late fall–run rearing curves were used to quantify steelhead rearing WUA, as discussed in the text.) ACID = Anderson-Cottonwood Irrigation District.

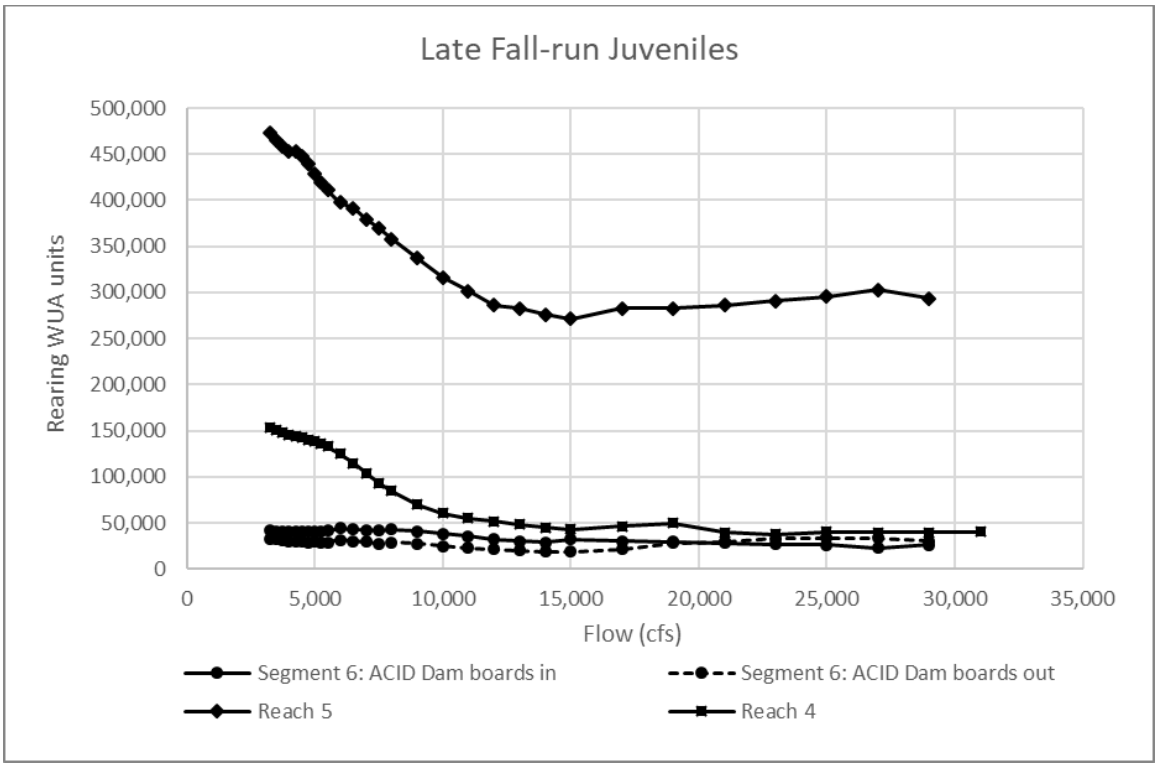

Figure 11K-16. Rearing WUA Curves for Late Fall–Run Chinook Salmon Juveniles in the Sacramento River, Segments 4 to 6. (The late fall–run rearing curves were used to quantify steelhead rearing WUA, as discussed in the text.) ACID = Anderson-Cottonwood Irrigation District.

As noted above, there are no spring-run or steelhead rearing WUA curves in the USFWS documentation, so the fall-run and late fall–run Chinook salmon rearing WUA curves were used as surrogates to model rearing habitat for spring-run and steelhead, respectively. Mark Gard, who led the USFWS studies that produced the Sacramento River WUA curves, has endorsed this practice for both spring-run Chinook salmon and steelhead (Gard pers. comm.). The use of these substitutions has been adopted in subsequent studies. For instance, the SacEFT model, which produces spawning and rearing WUA outputs for CV spring-run Chinook salmon and steelhead, derives the spring-run spawning and rearing WUA results using the fall-run WUA curves as surrogates and the steelhead rearing WUA results using the late fall–run WUA curves as surrogates (ESSA Technologies 2011; Robinson pers. comm.). It should be noted that this practice introduces additional uncertainty to the spring-run and steelhead results.

A potential limitation of the WUA curves presented above, as of all such habitat-based studies, is that they assume the channel characteristics of the river during the time of field data collection by USFWS (1995–1999), such as proportions of mesohabitat types, have remained in dynamic equilibrium to the present time and would continue to do so through the life of the Project. If the channel characteristics substantially change, the shape of the curves may no longer be applicable. A further limitation is that the curves were developed for the Sacramento River upstream of Battle Creek, but all races of Chinook salmon and steelhead spend time rearing downstream of this part of the river.

Differences in the mean rearing WUA under Alternatives 1–3 and the NAA were examined for the months of the fry and juvenile rearing period under each water year type and all water year types combined. Differences in mean rearing WUA of greater than 5% were flagged in the results tables to highlight results with the largest differences.

11K.3 Results

11K.3.1. Spawning Habitat Weighted Usable Area

11K.3.1.1. Sacramento River

Winter-run Chinook Salmon

Spawning WUA for winter-run Chinook salmon was determined by USFWS (2003a) for a range of flows in the three segments of the Sacramento River between Keswick Dam and the Battle Creek confluence (Figure 11K-1). About 46% of winter-run redds occur with Segment 6, which stretches 2 miles from Keswick Dam to the ACID Dam (Table 11K-1), and most of the remainder occur within Segment 5, which lies between the ACID Dam and the Cow Creek confluence, a distance of 18.5 miles.

To estimate changes in winter-run spawning WUA that would result from Alternatives 1–3, the flow versus spawning habitat WUA relationship developed for each of the three segments was used with mean monthly CALSIM II flows for the corresponding segments of the river under Alternatives 1–3 and the NAA during the winter-run spawning period (April through July (Table 11A-2 in Appendix 11A, *Aquatic Species Life Histories*; hereinafter referred to as Appendix 11A).

Differences in winter-run spawning WUA under Alternatives 1–3 and the NAA were examined using the grand mean spawning WUA for each month of the spawning period under each water year type and all water year types combined. In the tables of results, means that differed by >5% were highlighted in red for >5% reductions or green for >5% increases to flag the largest differences. The means differ by less than 5% for most months and water year types, but mean WUA in Segment 6 under Alternatives 1–3 is 5% to 6% lower than WUA under the NAA in May of critically dry years (Table 11K-2). In Segment 5, WUA consistently differs little between Alternatives 1–3 and the NAA (Table 11K-3). In Segment 4, WUA in May of critically dry years under Alternatives 1–3 and WUA in June and August of above normal and/or below normal years under Alternative 3, are slightly greater than WUA under the NAA (Table 11K-4).

These results indicate that in May of critically dry years, Alternatives 1–3 would result in reductions of spawning habitat in Segment 6 and increases of spawning habitat in Segment 4. Note that spawning habitat conditions for winter-run are much more important in Segment 6 than in Segment 4. In general, Alternatives 1–3 are not expected to substantially affect winter-run spawning WUA.

Table 11K-2. Winter-run Spawning WUA[a] in the Sacramento River, Segment 6, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
April	Wet	200	199 (-0.5%)	199 (-0.5%)	199 (-0.5%)	199 (-0.5%)
	Above Normal	183	184 (0.3%)	185 (1.2%)	184 (0.3%)	185 (1.2%)
	Below Normal	144	142 (-1.2%)	141 (-1.7%)	142 (-1.2%)	144 (0.1%)
	Dry	151	148 (-2.1%)	145 (-4.1%)	148 (-2.1%)	145 (-4.4%)
	Critically Dry	150	152 (1.3%)	151 (1%)	152 (1.3%)	143 (-4.2%)
	All	170	169 (-0.6%)	168 (-0.9%)	169 (-0.6%)	167 (-1.4%)
May	Wet	284	283 (-0.3%)	283 (-0.3%)	283 (-0.3%)	283 (-0.3%)
	Above Normal	281	279 (-0.7%)	279 (-0.7%)	279 (-0.7%)	279 (-0.8%)
	Below Normal	269	264 (-1.9%)	257 (-4.3%)	264 (-1.9%)	258 (-4.1%)
	Dry	271	266 (-1.7%)	264 (-2.5%)	266 (-1.7%)	261 (-3.6%)
	Critically Dry	276	262 (-5.1%)^	260 (-5.6%)^	262 (-5.2%)^	259 (-6.1%)^
	All	277	272 (-1.6%)	270 (-2.3%)	272 (-1.6%)	270 (-2.6%)
June	Wet	292	291 (-0.4%)	291 (-0.4%)	291 (-0.4%)	291 (-0.4%)
	Above Normal	305	304 (-0.2%)	301 (-1.2%)	304 (-0.2%)	299 (-1.9%)
	Below Normal	296	295 (-0.4%)	294 (-0.8%)	295 (-0.4%)	293 (-0.8%)
	Dry	297	297 (0.1%)	296 (-0.2%)	297 (0.1%)	297 (0.1%)
	Critically Dry	298	298 (0%)	297 (0%)	297 (-0.1%)	299 (0.3%)
	All	296	296 (-0.2%)	295 (-0.5%)	296 (-0.2%)	295 (-0.5%)
July	Wet	291	291 (0%)	291 (0%)	291 (0%)	291 (0%)
	Above Normal	274	275 (0.2%)	275 (0.3%)	275 (0.2%)	277 (1%)
	Below Normal	285	284 (-0.3%)	284 (-0.3%)	284 (-0.3%)	285 (-0.1%)
	Dry	295	293 (-0.6%)	293 (-0.7%)	293 (-0.6%)	295 (0%)
	Critically Dry	300	300 (-0.1%)	300 (-0.1%)	300 (0%)	301 (0.3%)
	All	290	289 (-0.2%)	289 (-0.2%)	290 (-0.2%)	290 (0.1%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-3. Winter-run Spawning WUA[a] in the Sacramento River, Segment 5, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
April	Wet	628	626 (-0.2)	626 (-0.2)	626 (-0.2)	626 (-0.2)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	Above Normal	666	667 (0.1)	669 (0.4)	667 (0.1)	669 (0.4)
	Below Normal	627	625 (-0.4)	623 (-0.7)	625 (-0.4)	626 (-0.2)
	Dry	635	629 (-0.9)	628 (-1.1)	629 (-0.8)	627 (-1.2)
	Critically Dry	637	642 (0.8)	642 (0.7)	642 (0.8)	629 (-1.4)
	All	636	635 (-0.2)	635 (-0.3)	635 (-0.2)	633 (-0.5)
May	Wet	735	734 (-0.2)	734 (-0.2)	734 (-0.2)	734 (-0.2)
	Above Normal	755	754 (-0.2)	754 (-0.2)	754 (-0.2)	754 (-0.2)
	Below Normal	767	761 (-0.7)	757 (-1.3)	761 (-0.7)	760 (-0.9)
	Dry	775	770 (-0.6)	769 (-0.7)	770 (-0.6)	767 (-1)
	Critically Dry	782	772 (-1.3)	771 (-1.4)	772 (-1.3)	767 (-1.9)
	All	759	755 (-0.6)	754 (-0.7)	755 (-0.6)	753 (-0.8)
June	Wet	768	768 (0)	768 (0)	768 (0)	768 (0)
	Above Normal	782	783 (0.2)	794 (1.6)	783 (0.2)	795 (1.7)
	Below Normal	739	739 (0)	744 (0.6)	739 (0)	766 (3.6)
	Dry	726	736 (1.5)	729 (0.5)	736 (1.5)	741 (2.1)
	Critically Dry	778	777 (-0.1)	781 (0.4)	777 (-0.1)	783 (0.6)
	All	757	760 (0.3)	761 (0.5)	760 (0.3)	768 (1.4)
July	Wet	663	660 (-0.4)	660 (-0.4)	660 (-0.4)	660 (-0.4)
	Above Normal	576	579 (0.5)	590 (2.5)	579 (0.5)	603 (4.8)
	Below Normal	631	625 (-0.9)	629 (-0.3)	625 (-0.9)	632 (0.2)
	Dry	682	671 (-1.5)	667 (-2.1)	671 (-1.5)	684 (0.3)
	Critically Dry	777	774 (-0.4)	774 (-0.3)	775 (-0.2)	779 (0.3)
	All	667	662 (-0.6)	664 (-0.4)	663 (-0.6)	670 (0.6)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-4. Winter-run Spawning WUA[a] in the Sacramento River, Segment 4, and Percent Differences (in parentheses) between the No Action Alternative (NAA) Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
April	Wet	152	153 (0.2)	153 (0.2)	153 (0.2)	153 (0.2)
	Above Normal	184	184 (-0.1)	184 (-0.4)	184 (-0.1)	184 (-0.4)
	Below Normal	200	201 (0.3)	201 (0)	201 (0.3)	200 (-0.2)
	Dry	204	204 (-0.1)	206 (0.8)	204 (-0.1)	206 (0.9)
	Critically Dry	206	208 (0.8)	208 (0.8)	208 (0.8)	207 (0.3)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	All	185	185 (0.2)	185 (0.3)	185 (0.2)	185 (0.2)
May	Wet	146	146 (0.2)	146 (0.2)	146 (0.2)	146 (0.2)
	Above Normal	161	162 (0.5)	162 (0.6)	162 (0.5)	162 (0.6)
	Below Normal	177	178 (0.8)	183 (3.4)	178 (0.8)	183 (3.6)
	Dry	177	180 (1.3)	181 (1.9)	180 (1.3)	183 (3.1)
	Critically Dry	180	190 (5.4)^	191 (5.9) ^	190 (5.4) ^	190 (5.3) ^
	All	165	168 (1.4)	169 (2.1)	168 (1.4)	169 (2.4)
June	Wet	158	159 (0.6)	159 (0.6)	159 (0.6)	159 (0.6)
	Above Normal	153	153 (0.5)	160 (4.5)	153 (0.5)	163 (6.6) ^
	Below Normal	154	156 (1)	158 (2.3)	156 (1)	164 (6.5) ^
	Dry	151	153 (1.4)	152 (0.8)	153 (1.4)	155 (2.3)
	Critically Dry	166	165 (-0.2)	166 (0.4)	166 (0)	166 (0)
	All	156	157 (0.7)	158 (1.5)	157 (0.7)	160 (2.7)
July	Wet	137	137 (-0.2)	137 (-0.2)	137 (-0.2)	137 (-0.2)
	Above Normal	128	129 (0.3)	131 (2.1)	129 (0.3)	134 (4.2)
	Below Normal	136	136 (-0.5)	136 (-0.1)	136 (-0.5)	137 (0.6)
	Dry	145	143 (-0.8)	143 (-1.2)	143 (-0.9)	145 (0.1)
	Critically Dry	166	165 (-0.2)	165 (-0.1)	165 (-0.1)	165 (-0.3)
	All	142	141 (-0.3)	142 (-0.1)	141 (-0.3)	142 (0.5)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Spring-run Chinook Salmon

Spawning habitat for spring-run Chinook salmon was not estimated directly by USFWS (2003a, 2006) and no spring-run Chinook salmon WUA curves for the Sacramento River have been located, so spring-run spawning habitat was modeled using the WUA curves provided by USFWS (2003b, 2006) for fall-run Chinook salmon. However, as noted by USFWS (2003a), the validity of using the fall-run WUA curves to characterize spring-run spawning habitat is uncertain.

To evaluate the effects of the NAA and Alternatives 1–3 on spring-run spawning habitat, spring-run spawning WUA was estimated for flows during the August through October spawning period under Alternatives 1–3 and the NAA in the same three segments of the Sacramento River that were used for winter-run (Figure 11K-1). The redd distribution data for spring-run indicate that about 12%, 66% and 13% of spring-run redds occur within Segments 6, 5, and 4, respectively (Table 11K-1).

Mean spawning WUA for spring-run under Alternatives 1–3 differs from the NAA by more than 5% for only a few months and water year types, with most of these differences occurring under

Alternative 3 (Table 11K-5 through Table 11K-7). The largest difference is a 17% increase under Alternative 3 in Segment 5 for August of above normal water years (Table 11K-6). This difference is the largest difference in spawning WUA found for any of the salmonids. The largest reduction in spawning WUA for spring-run is a 9% reduction, under Alternative 3 in Segment 5 for September of above normal years. October of critically dry years shows reductions of >5% under Alternatives 1–3 in Segment 4.

These results indicate that Alternatives 1–3 would result in some moderate reductions of spawning habitat during September and October, primarily under Alternative 3. As noted above, spawning habitat conditions for spring-run are most important in Segment 5, which has no changes in WUA >5%, except for one large increase and one large reduction (Table 11K-6). Alternatives 1–3 are not expected to substantially affect spring-run spawning WUA in the Sacramento River.

Table 11K-5. Spring-run Spawning WUA[a] in the Sacramento River, Segment 6, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
August	Wet	236	235 (-0.1)	235 (-0.1)	235 (-0.1)	235 (-0.1)
	Above Normal	240	241 (0.4)	240 (-0.2)	241 (0.4)	258 (7.3)*
	Below Normal	260	261 (0.2)	261 (0.2)	261 (0.1)	263 (1)
	Dry	274	270 (-1.6)	270 (-1.4)	270 (-1.7)	275 (0.4)
	Critically Dry	292	295 (1)	292 (-0.2)	292 (-0.2)	293 (0.1)
	All	257	257 (-0.2)	256 (-0.4)	256 (-0.4)	261 (1.2)
September	Wet	250	249 (-0.3)	249 (-0.4)	249 (-0.3)	249 (-0.3)
	Above Normal	292	293 (0)	287 (-1.7)	292 (0)	278 (-4.8)
	Below Normal	321	320 (-0.5)	321 (-0.2)	320 (-0.4)	320 (-0.3)
	Dry	306	305 (-0.1)	308 (0.9)	305 (-0.1)	307 (0.5)
	Critically Dry	295	301 (2)	301 (1.9)	300 (1.8)	299 (1.3)
	All	287	287 (0.1)	287 (0.1)	287 (0.1)	286 (-0.5)
October	Wet	295	295 (0)	296 (0.1)	295 (0)	295 (0)
	Above Normal	324	324 (0.1)	324 (0)	324 (0.1)	321 (-0.7)
	Below Normal	308	307 (-0.2)	306 (-0.5)	306 (-0.4)	307 (-0.1)
	Dry	305	304 (-0.1)	307 (0.9)	304 (-0.1)	309 (1.5)
	Critically Dry	311	313 (0.5)	314 (0.9)	313 (0.6)	314 (1.1)
	All	306	306 (0)	307 (0.3)	306 (0)	307 (0.4)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-6. Spring-run Spawning WUA[a] in the Sacramento River, Segment 5, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
August	Wet	306	305 (-0.1)	305 (-0.1)	305 (-0.1)	305 (-0.1)
	Above Normal	319	321 (0.9)	318 (-0.3)	321 (0.9)	372 (16.8)*
	Below Normal	381	383 (0.5)	383 (0.6)	382 (0.3)	389 (2.1)
	Dry	425	410 (-3.5)	412 (-2.9)	410 (-3.5)	429 (1)
	Critically Dry	473	481 (1.7)	471 (-0.4)	471 (-0.4)	474 (0.1)
	All	372	370 (-0.4)	369 (-0.8)	369 (-0.8)	381 (2.6)
September	Wet	346	344 (-0.4)	344 (-0.5)	344 (-0.4)	344 (-0.4)
	Above Normal	475	474 (-0.1)	456 (-3.8)	474 (-0.2)	430 (-9.4)^
	Below Normal	587	584 (-0.5)	584 (-0.6)	584 (-0.5)	581 (-1.1)
	Dry	589	584 (-0.8)	590 (0.1)	584 (-0.8)	589 (0.1)
	Critically Dry	583	587 (0.7)	586 (0.5)	587 (0.6)	584 (0.2)
	All	494	493 (-0.3)	491 (-0.6)	493 (-0.3)	487 (-1.5)
October	Wet	483	483 (0)	484 (0.1)	483 (0)	483 (0)
	Above Normal	583	581 (-0.4)	578 (-0.9)	581 (-0.4)	560 (-4)
	Below Normal	555	555 (0)	552 (-0.7)	553 (-0.4)	544 (-2)
	Dry	577	576 (-0.1)	583 (1.1)	576 (-0.1)	580 (0.6)
	Critically Dry	579	567 (-2)	571 (-1.4)	569 (-1.6)	572 (-1.2)
	All	544	542 (-0.4)	543 (-0.2)	542 (-0.4)	539 (-0.9)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-7. Spring-run Spawning WUA[a] in the Sacramento River, Segment 4, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
August	Wet	123	123 (-0.1)	123 (-0.1)	123 (-0.1)	123 (-0.1)
	Above Normal	129	129 (0.3)	128 (-0.3)	129 (0.3)	136 (5.8)^
	Below Normal	138	138 (0.1)	138 (0.1)	138 (0.1)	138 (0.4)
	Dry	141	140 (-0.4)	140 (-0.4)	140 (-0.5)	141 (0)
	Critically Dry	146	146 (0.1)	145 (-0.7)	145 (-0.6)	144 (-0.9)
	All	134	134 (-0.1)	133 (-0.3)	133 (-0.2)	135 (0.7)
September	Wet	132	133 (0.3)	133 (0.2)	133 (0.3)	133 (0.3)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	Above Normal	147	146 (-0.6)	141 (-4.5)	146 (-0.8)	139 (-5.7)*
	Below Normal	194	195 (0.3)	192 (-0.9)	195 (0.4)	189 (-2.5)
	Dry	226	221 (-2.4)	221 (-2.5)	221 (-2.4)	222 (-1.6)
	Critically Dry	241	232 (-3.4)	232 (-3.6)	233 (-3.1)	233 (-3.2)
	All	182	180 (-1.3)	178 (-2)	180 (-1.2)	178 (-2.1)
October	Wet	151	151 (-0.1)	151 (0)	151 (-0.1)	151 (-0.1)
	Above Normal	167	165 (-1.1)	164 (-1.7)	165 (-1.1)	158 (-5.4)*
	Below Normal	176	177 (0.8)	175 (-0.1)	176 (0.6)	169 (-3.4)
	Dry	197	197 (-0.1)	198 (0.6)	197 (-0.1)	192 (-2.4)
	Critically Dry	192	179 (-6.8)*	180 (-6.4)*	180 (-6.4)*	181 (-6)*
	All	173	171 (-1.2)	172 (-1.1)	171 (-1.1)	168 (-2.9)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Fall-run Chinook Salmon

Spawning habitat WUA for fall-run Chinook salmon was determined by USFWS (2003a, 2006) in the same manner that it was determined for winter-run Chinook salmon. To evaluate the effects of Alternatives 1–3 on fall-run spawning habitat, fall-run spawning WUA was estimated for flows during the September through November spawning period under the NAA and Alternatives 1–3 in the same three segments of the Sacramento River that were used for winter-run and spring-run Chinook salmon. However, because fall-run spawning occurs further downstream than spawning of the other runs, fall-run spawning WUA was estimated for an additional downstream segment (Segment 3) (Figure 11K-1; Table 11K-1).

Mean spawning WUA for fall-run under Alternatives 1–3 differ by more than 5% from the NAA means for several months and water year types in Segments 6 and 4 (Table 11K-8 and Table 11K-10), but for Segments 5 and 3 they differ only under Alternative 3 in September of above normal water years (Table 11K-9 and Table 11K-11). All >5% changes in WUA are reductions and none are greater than 10%. More than half of the reductions in means that are >5% occur under Alternative 3. Note that the spawning WUA results for fall-run (Table 11K-8 through Table 11K-10) are identical to those for spring-run (Table 11K-5 through Table 11K-7) where the spawning periods and river segments overlap because both runs use the fall-run WUA curves for the WUA computations.

These results indicate that Alternatives 1–3 would result in frequent minor reductions in spawning habitat WUA for fall-run, and occasional somewhat greater reductions, primarily for Alternative 3.

Table 11K-8. Fall-run Spawning WUA[a] in the Sacramento River, Segment 6, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
September	Wet	250	249 (-0.3%)	249 (-0.4%)	249 (-0.3%)	249 (-0.3%)
	Above Normal	292	293 (0%)	287 (-1.7%)	292 (0%)	278 (-4.8%)
	Below Normal	321	320 (-0.5%)	321 (-0.2%)	320 (-0.4%)	320 (-0.3%)
	Dry	306	305 (-0.1%)	308 (0.9%)	305 (-0.1%)	307 (0.5%)
	Critically Dry	295	301 (2%)	301 (1.9%)	300 (1.8%)	299 (1.3%)
	All	287	287 (0.1%)	287 (0.1%)	287 (0.1%)	286 (-0.5%)
October	Wet	295	295 (0%)	296 (0.1%)	295 (0%)	295 (0%)
	Above Normal	324	324 (0.1%)	324 (0%)	324 (0.1%)	321 (-0.7%)
	Below Normal	308	307 (-0.2%)	306 (-0.5%)	306 (-0.4%)	307 (-0.1%)
	Dry	305	304 (-0.1%)	307 (0.9%)	304 (-0.1%)	309 (1.5%)
	Critically Dry	311	313 (0.5%)	314 (0.9%)	313 (0.6%)	314 (1.1%)
	All	306	306 (0%)	307 (0.3%)	306 (0%)	307 (0.4%)
November	Wet	146	146 (0.2%)	149 (2.3%)	146 (0.2%)	148 (2%)
	Above Normal	142	142 (-0.3%)	145 (2.2%)	142 (-0.2%)	142 (0.1%)
	Below Normal	182	179 (-1.4%)	173 (-5%)	179 (-1.2%)	169 (-7.2%)*
	Dry	217	219 (0.9%)	205 (-5.5%)*	222 (2%)	207 (-4.9%)
	Critically Dry	217	217 (0.2%)	216 (-0.6%)	216 (-0.3%)	218 (0.6%)
	All	178	178 (0.1%)	175 (-1.5%)	179 (0.3%)	175 (-1.8%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-9. Fall-run Spawning WUA[a] in the Sacramento River, Segment 5, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
September	Wet	346	344 (-0.4)%	344 (-0.5%)	344 (-0.4%)	344 (-0.4%)
	Above Normal	475	474 (-0.1)%	456 (-3.8%)	474 (-0.2%)	430 (-9.4%)*
	Below Normal	587	584 (-0.5)%	584 (-0.6%)	584 (-0.5%)	581 (-1.1%)
	Dry	589	584 (-0.8)%	590 (0.1%)	584 (-0.8%)	589 (0.1%)
	Critically Dry	583	587 (0.7)%	586 (0.5%)	587 (0.6%)	584 (0.2%)
	All	494	493 (-0.3)%	491 (-0.6%)	493 (-0.3%)	487 (-1.5%)
October	Wet	483	483 (0)%	484 (0.1%)	483 (0%)	483 (0%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	Above Normal	583	581 (-0.4)%	578 (-0.9%)	581 (-0.4%)	560 (-4%)
	Below Normal	555	555 (0)%	552 (-0.7%)	553 (-0.4%)	544 (-2%)
	Dry	577	576 (-0.1)%	583 (1.1%)	576 (-0.1%)	580 (0.6%)
	Critically Dry	579	567 (-2)%	571 (-1.4%)	569 (-1.6%)	572 (-1.2%)
	All	544	542 (-0.4)%	543 (-0.2%)	542 (-0.4%)	539 (-0.9%)
November	Wet	514	516 (0.5)%	519 (1%)	516 (0.5%)	519 (1%)
	Above Normal	491	491 (-0.1)%	496 (0.9%)	491 (0%)	496 (1%)
	Below Normal	552	551 (-0.2)%	543 (-1.6%)	551 (-0.2%)	539 (-2.4%)
	Dry	555	559 (0.6)%	552 (-0.7%)	560 (0.9%)	550 (-1%)
	Critically Dry	575	575 (0)%	574 (-0.2%)	574 (-0.1%)	573 (-0.4%)
	All	536	538 (0.2)%	536 (0%)	538 (0.3%)	535 (-0.3%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-10. Fall-run Spawning WUA[a] in the Sacramento River, Segment 4, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
September	Wet	132	133 (0.3%)	133 (0.2%)	133 (0.3%)	133 (0.3%)
	Above Normal	147	146 (-0.6%)	141 (-4.5%)	146 (-0.8%)	139 (-5.7%)*
	Below Normal	194	195 (0.3%)	192 (-0.9%)	195 (0.4%)	189 (-2.5%)
	Dry	226	221 (-2.4%)	221 (-2.5%)	221 (-2.4%)	222 (-1.6%)
	Critically Dry	241	232 (-3.4%)	232 (-3.6%)	233 (-3.1%)	233 (-3.2%)
	All	182	180 (-1.3%)	178 (-2%)	180 (-1.2%)	178 (-2.1%)
October	Wet	151	151 (-0.1%)	151 (0%)	151 (-0.1%)	151 (-0.1%)
	Above Normal	167	165 (-1.1%)	164 (-1.7%)	165 (-1.1%)	158 (-5.4%)*
	Below Normal	176	177 (0.8%)	175 (-0.1%)	176 (0.6%)	169 (-3.4%)
	Dry	197	197 (-0.1%)	198 (0.6%)	197 (-0.1%)	192 (-2.4%)
	Critically Dry	192	179 (-6.8%)*	180 (-6.4%)*	180 (-6.4%)*	181 (-6%)*
	All	173	171 (-1.2%)	172 (-1.1%)	171 (-1.1%)	168 (-2.9%)
November	Wet	146	146 (-0.3%)	147 (0.9%)	146 (-0.3%)	147 (0.7%)
	Above Normal	142	142 (-0.2%)	142 (0.4%)	142 (-0.2%)	141 (-0.6%)
	Below Normal	168	167 (-0.6%)	164 (-2.1%)	167 (-0.5%)	165 (-1.7%)
	Dry	190	191 (0.6%)	180 (-4.8%)	192 (1.4%)	181 (-4.3%)
	Critically Dry	200	200 (-0.3%)	199 (-0.7%)	199 (-0.5%)	202 (0.9%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	All	167	167 (-0.1%)	165 (-1.3%)	167 (0.1%)	165 (-1%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-11. Fall-run Spawning WUA[a] in the Sacramento River, Segment 3, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
September	Wet	1169	1168 (-0.1%)	1166 (-0.2%)	1168 (-0.1%)	1168 (-0.1%)
	Above Normal	1462	1461 (-0.1%)	1421 (-2.8%)	1460 (-0.2%)	1374 (-6.1%)*
	Below Normal	1731	1727 (-0.3%)	1723 (-0.5%)	1728 (-0.2%)	1712 (-1.1%)
	Dry	1776	1762 (-0.8%)	1772 (-0.2%)	1763 (-0.7%)	1775 (0%)
	Critically Dry	1777	1776 (-0.1%)	1774 (-0.2%)	1775 (-0.2%)	1777 (0%)
	All	1531	1526 (-0.3%)	1522 (-0.6%)	1526 (-0.3%)	1515 (-1%)
October	Wet	1452	1452 (0%)	1453 (0.1%)	1452 (0%)	1452 (0%)
	Above Normal	1662	1653 (-0.5%)	1642 (-1.2%)	1653 (-0.5%)	1592 (-4.2%)
	Below Normal	1621	1622 (0.1%)	1615 (-0.4%)	1618 (-0.2%)	1586 (-2.2%)
	Dry	1717	1714 (-0.2%)	1730 (0.8%)	1714 (-0.2%)	1717 (0%)
	Critically Dry	1711	1667 (-2.6%)	1674 (-2.2%)	1672 (-2.3%)	1678 (-2%)
	All	1606	1598 (-0.5%)	1601 (-0.4%)	1598 (-0.5%)	1586 (-1.3%)
November	Wet	1417	1420 (0.2%)	1430 (0.9%)	1421 (0.3%)	1429 (0.8%)
	Above Normal	1402	1402 (0%)	1414 (0.8%)	1402 (0%)	1408 (0.4%)
	Below Normal	1557	1550 (-0.4%)	1524 (-2.1%)	1551 (-0.4%)	1514 (-2.8%)
	Dry	1655	1664 (0.6%)	1629 (-1.6%)	1671 (1%)	1635 (-1.2%)
	Critically Dry	1734	1742 (0.5%)	1737 (0.2%)	1738 (0.3%)	1741 (0.4%)
	All	1541	1544 (0.2%)	1536 (-0.3%)	1545 (0.3%)	1535 (-0.4%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Late Fall–run Chinook Salmon

Spawning habitat WUA for late fall–run Chinook salmon was determined by USFWS (2003a, 2006) in the same manner that it was determined for winter-run and fall-run Chinook salmon. To evaluate the effects of Alternatives 1–3 on late fall–run spawning habitat, late fall–run spawning WUA was computed for flows during the December through March spawning period under Alternatives 1–3 and the NAA in all three segments of the Sacramento River that were used for the other runs, but not Segment 3, which was used for the fall-run effects analysis only. About

90% of late fall–run redds occur in the three upstream segments, and 68% are found in Segment 6 (Table 11K-1).

Mean spawning WUA under Alternatives 1–3 differs by greater than 5% from the NAA mean only under Alternative 3 for December of above normal and dry water years and February of above normal years (Table 11K-12 and Table 11K-14). The results indicate that Alternatives 1 and 2 would have little effect on late fall–run spawning WUA and Alternative 3 would have minor adverseeffects.

Table 11K-12. Late Fall–run Spawning WUA[a] in the Sacramento River, Segment 6, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
December	Wet	174	175 (0.6)%	174 (0.4)%	175 (0.5)%	174 (0.2)%
	Above Normal	189	189 (0.1)%	183 (-3.2)%	189 (0.1)%	179 (-5.2)%*
	Below Normal	170	170 (-0.4)%	169 (-1.1)%	170 (-0.5)%	164 (-3.9)%
	Dry	195	191 (-2.2)%	191 (-2)%	191 (-2.2)%	184 (-5.9)%*
	Critically Dry	256	260 (1.2)%	257 (0.3)%	257 (0.2)%	256 (-0.1)%
	All	193	193 (-0.1)%	191 (-0.8)%	192 (-0.4)%	188 (-2.5)%
January	Wet	109	109 (0.6)%	109 (0.7)%	109 (0.6)%	110 (0.8)%
	Above Normal	170	170 (-0.1)%	170 (-0.1)%	170 (-0.1)%	170 (-0.1)%
	Below Normal	232	232 (0)%	233 (0.3)%	232 (0)%	233 (0.3)%
	Dry	258	259 (0.2)%	259 (0.2)%	259 (0.2)%	259 (0.2)%
	Critically Dry	253	250 (-1.1)%	253 (0.1)%	252 (-0.1)%	255 (0.8)%
	All	193	193 (-0.1)%	193 (0.3)%	193 (0.1)%	194 (0.4)%
February	Wet	112	111 (-0.3)%	111 (-0.3)%	111 (-0.3)%	111 (-0.3)%
	Above Normal	133	131 (-1.3)%	130 (-2.3)%	131 (-1.5)%	128 (-4)%
	Below Normal	189	189 (0.1)%	186 (-1.4)%	191 (1.1)%	181 (-3.8)%
	Dry	257	259 (0.6)%	258 (0.4)%	259 (0.6)%	257 (0)%
	Critically Dry	259	261 (0.9)%	260 (0.7)%	260 (0.7)%	261 (1)%
	All	181	182 (0.2)%	181 (-0.3)%	182 (0.3)%	180 (-1)%
March	Wet	114	114 (0)%	114 (0)%	114 (0)%	114 (0)%
	Above Normal	133	133 (-0.2)%	132 (-0.6)%	133 (-0.2)%	132 (-0.6)%
	Below Normal	239	239 (0)%	239 (0)%	239 (0)%	239 (0)%
	Dry	238	241 (1)%	239 (0.5)%	240 (0.9)%	237 (-0.7)%
	Critically Dry	240	238 (-0.7)%	239 (-0.4)%	239 (-0.6)%	240 (-0.2)%
	All	184	184 (0.1)%	184 (0)%	184 (0.1)%	183 (-0.3)%

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-13. Late Fall–run Spawning WUA[a] in the Sacramento River, Segment 5, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
December	Wet	438	438 (0.1)%	439 (0.2)%	438 (0.1)%	439 (0.2)%
	Above Normal	461	460 (-0.3)%	455 (-1.4)%	460 (-0.3)%	446 (-3.4)%
	Below Normal	431	432 (0.1)%	431 (-0.1)%	432 (0.1)%	429 (-0.5)%
	Dry	438	436 (-0.4)%	443 (1)%	436 (-0.5)%	428 (-2.3)%
	Critically Dry	510	516 (1.2)%	514 (0.8)%	514 (0.8)%	516 (1.2)%
	All	451	452 (0.1)%	452 (0.2)%	452 (0)%	448 (-0.8)%
January	Wet	275	274 (-0.5)%	273 (-0.7)%	274 (-0.5)%	273 (-0.8)%
	Above Normal	392	392 (-0.1)%	392 (-0.1)%	392 (-0.1)%	392 (-0.1)%
	Below Normal	502	502 (0)%	501 (-0.2)%	502 (0)%	501 (-0.3)%
	Dry	502	500 (-0.3)%	500 (-0.3)%	500 (-0.3)%	500 (-0.3)%
	Critically Dry	513	509 (-0.8)%	514 (0)%	513 (-0.1)%	515 (0.4)%
	All	416	414 (-0.3)%	414 (-0.3)%	415 (-0.2)%	415 (-0.2)%
February	Wet	259	259 (-0.3)%	259 (-0.3)%	259 (-0.3)%	259 (-0.3)%
	Above Normal	294	289 (-1.7)%	284 (-3.4)%	288 (-1.9)%	273 (-7.1)%*
	Below Normal	457	457 (0)%	455 (-0.6)%	461 (0.8)%	447 (-2.3)%
	Dry	506	506 (-0.1)%	502 (-0.9)%	506 (-0.1)%	503 (-0.6)%
	Critically Dry	520	517 (-0.6)%	517 (-0.6)%	517 (-0.6)%	517 (-0.6)%
	All	391	389 (-0.4)%	387 (-0.9)%	389 (-0.3)%	384 (-1.6)%
March	Wet	307	307 (0)%	307 (0)%	307 (0)%	307 (0)%
	Above Normal	377	376 (-0.4)%	373 (-0.9)%	376 (-0.3)%	374 (-0.9)%
	Below Normal	468	468 (0)%	468 (0)%	468 (0)%	468 (0)%
	Dry	506	502 (-0.7)%	500 (-1.2)%	502 (-0.8)%	504 (-0.5)%
	Critically Dry	518	514 (-0.9)%	518 (-0.1)%	514 (-0.9)%	516 (-0.5)%
	All	419	418 (-0.4)%	417 (-0.5)%	418 (-0.4)%	418 (-0.3)%

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-14. Late Fall–run Spawning WUA[a] in the Sacramento River, Segment 4, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
December	Wet	360	362 (0.4)%	361 (0.3)%	362 (0.4)%	361 (0.1)%
	Above Normal	365	366 (0.4)%	361 (-1)%	366 (0.4)%	357 (-2)%
	Below Normal	357	355 (-0.4)%	352 (-1.4)%	355 (-0.6)%	346 (-3)%
	Dry	381	375 (-1.7)%	374 (-1.9)%	375 (-1.7)%	369 (-3.1)%
	Critically Dry	494	498 (0.8)%	494 (0.1)%	494 (0)%	493 (-0.3)%
	All	386	385 (-0.1)%	383 (-0.7)%	385 (-0.3)%	380 (-1.4)%
January	Wet	176	176 (0.4)%	176 (0.4)%	176 (0.5)%	176 (0.5)%
	Above Normal	265	265 (-0.1)%	265 (-0.1)%	265 (-0.1)%	265 (-0.1)%
	Below Normal	419	419 (0)%	420 (0.2)%	419 (0)%	419 (0.1)%
	Dry	493	494 (0.2)%	494 (0.2)%	494 (0.2)%	494 (0.2)%
	Critically Dry	504	501 (-0.7)%	505 (0.1)%	504 (-0.1)%	507 (0.6)%
	All	348	348 (0)%	349 (0.2)%	348 (0.1)%	349 (0.3)%
February	Wet	178	177 (-0.4)%	177 (-0.4)%	177 (-0.4)%	177 (-0.4)%
	Above Normal	200	197 (-1.3)%	195 (-2.5)%	197 (-1.4)%	189 (-5.3)%*
	Below Normal	341	342 (0.2)%	340 (-0.3)%	346 (1.4)%	337 (-1.4)%
	Dry	455	459 (0.8)%	457 (0.3)%	459 (0.8)%	455 (-0.1)%
	Critically Dry	509	513 (0.8)%	512 (0.6)%	512 (0.6)%	513 (0.8)%
	All	318	319 (0.3)%	318 (-0.1)%	320 (0.4)%	316 (-0.6)%
March	Wet	203	203 (0)%	203 (0)%	203 (0)%	203 (0)%
	Above Normal	243	243 (-0.3)%	242 (-0.7)%	243 (-0.3)%	242 (-0.6)%
	Below Normal	433	433 (0)%	433 (0)%	433 (0)%	433 (0)%
	Dry	438	439 (0.3)%	438 (0.1)%	439 (0.3)%	436 (-0.3)%
	Critically Dry	480	478 (-0.2)%	479 (-0.2)%	479 (-0.2)%	480 (0.1)%
	All	340	340 (0)%	340 (-0.1)%	340 (0)%	340 (-0.1)%

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Steelhead

Spawning habitat WUA for steelhead in the Sacramento River was determined by USFWS (2003a, 2006) in the same manner that it was determined for winter-run, fall-run and late fall–run, except that HSC previously determined for steelhead in the American River (U.S. Fish and Wildlife Service 2003b) were used in developing the Sacramento River steelhead WUA curves (Section 11K.2, *Methods*). The spawning distribution of steelhead is uncertain, but most

spawning is assumed to occur in the upper three segments (Segments 6, 5, and 4), where most salmon spawning occurs and where temperature conditions are most suitable.

To evaluate the effects of Alternatives 1–3 on steelhead spawning habitat, steelhead spawning WUA was estimated for CALSIM II flows during the November through February spawning n period under Alternatives 1–3 and the NAA in the same three segments of the Sacramento River that were used for winter-run, spring-run and late fall–run.

There are few notable differences in steelhead mean spawning WUA between Alternatives 1–3 and the NAA in any of the river segments (Table 11K-15 and Table 11K-17). In fact, each segment has only one change >5%: a reduction in spawning WUA of 6% to 10% under Alternative 3 for February of above normal water years. These results indicate that Alternatives 1–3 would have minor effects on steelhead spawning WUA in the Sacramento River.

Table 11K-15. Steelhead Spawning WUA[a] in the Sacramento River, Segment 6, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
November	Wet	55	55 (0.2%)	55 (0.4%)	55 (0.2%)	55 (0.4%)
	Above Normal	53	53 (0%)	53 (0.3%)	53 (0%)	53 (0.2%)
	Below Normal	58	58 (-0.2%)	58 (-1%)	58 (-0.2%)	57 (-1.2%)
	Dry	60	60 (-0.2%)	59 (-2%)	60 (-0.1%)	59 (-2.3%)
	Critically Dry	61	61 (0.5%)	61 (0.2%)	61 (0.3%)	61 (0.2%)
	All	57	57 (0%)	57 (-0.4%)	57 (0%)	57 (-0.6%)
December	Wet	49	49 (0%)	49 (0%)	49 (0%)	49 (-0.1%)
	Above Normal	52	52 (0.4%)	52 (-0.6%)	52 (0.4%)	51 (-2%)
	Below Normal	49	49 (-0.3%)	48 (-1.6%)	49 (-0.4%)	47 (-4.4%)
	Dry	52	51 (-1.4%)	51 (-1.3%)	51 (-1.4%)	51 (-2.3%)
	Critically Dry	66	66 (-0.1%)	66 (-0.2%)	66 (-0.2%)	66 (-0.5%)
	All	53	53 (-0.3%)	53 (-0.6%)	53 (-0.4%)	52 (-1.6%)
January	Wet	33	33 (0.5%)	33 (0.7%)	33 (0.5%)	33 (0.7%)
	Above Normal	47	47 (-0.1%)	47 (-0.1%)	47 (-0.1%)	47 (-0.1%)
	Below Normal	63	63 (0%)	63 (0%)	63 (0%)	63 (0%)
	Dry	66	66 (0.2%)	66 (0.2%)	66 (0.2%)	66 (0.2%)
	Critically Dry	66	66 (-0.3%)	66 (0%)	66 (0%)	66 (0%)
	All	52	52 (0.1%)	52 (0.2%)	52 (0.1%)	52 (0.2%)
February	Wet	33	33 (-0.2%)	33 (-0.2%)	33 (-0.2%)	33 (-0.2%)
	Above Normal	36	35 (-1.4%)	35 (-3.1%)	35 (-1.6%)	32 (-9.5%)*
	Below Normal	52	52 (0.3%)	52 (-0.2%)	52 (0.6%)	51 (-0.4%)
	Dry	66	66 (0.5%)	66 (0.1%)	66 (0.5%)	66 (-0.2%)
	Critically Dry	66	66 (0.5%)	66 (0.5%)	66 (0.5%)	66 (0.5%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	All	48	49 (0.1%)	48 (-0.3%)	49 (0.2%)	48 (-1.1%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-16. Steelhead Spawning WUA[a] in the Sacramento River, Segment 5, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
Nov	Wet	155	155 (0.3%)	155 (0.3%)	155 (0.3%)	155 (0.3%)
	Above Normal	145	145 (0%)	146 (0.3%)	145 (0%)	146 (0.6%)
	Below Normal	158	159 (0.1%)	158 (-0.2%)	159 (0%)	158 (-0.5%)
	Dry	157	157 (-0.1%)	156 (-0.6%)	157 (-0.1%)	156 (-0.9%)
	Critically Dry	161	162 (0.5%)	161 (0.3%)	161 (0.4%)	161 (-0.1%)
	All	156	156 (0.2%)	156 (0%)	156 (0.1%)	155 (-0.1%)
December	Wet	132	132 (-0.1%)	132 (-0.1%)	132 (-0.1%)	132 (0%)
	Above Normal	139	139 (0%)	139 (-0.1%)	139 (0%)	137 (-1.6%)
	Below Normal	131	131 (0%)	131 (-0.6%)	131 (-0.1%)	129 (-2%)
	Dry	130	130 (-0.4%)	131 (0.1%)	130 (-0.5%)	129 (-1%)
	Critically Dry	156	157 (0.3%)	157 (0.4%)	157 (0.4%)	157 (0.5%)
	All	136	136 (-0.1%)	136 (0%)	136 (-0.1%)	135 (-0.7%)
January	Wet	84	84 (-0.3%)	84 (-0.5%)	84 (-0.3%)	84 (-0.6%)
	Above Normal	125	124 (-0.1%)	124 (-0.1%)	124 (-0.1%)	124 (-0.1%)
	Below Normal	155	155 (0%)	154 (-0.1%)	155 (0%)	154 (-0.2%)
	Dry	155	155 (-0.1%)	155 (-0.1%)	155 (-0.1%)	155 (-0.1%)
	Critically Dry	157	157 (-0.3%)	157 (0%)	157 (0%)	157 (-0.1%)
	All	128	128 (-0.2%)	128 (-0.2%)	128 (-0.1%)	128 (-0.2%)
February	Wet	78	78 (-0.2%)	78 (-0.2%)	78 (-0.2%)	78 (-0.2%)
	Above Normal	90	89 (-1.2%)	87 (-2.7%)	89 (-1.4%)	82 (-8.1%)*
	Below Normal	137	138 (0.3%)	138 (0%)	138 (0.6%)	137 (-0.2%)
	Dry	156	156 (0.1%)	155 (-0.5%)	156 (0.1%)	155 (-0.4%)
	Critically Dry	157	157 (0%)	157 (0%)	157 (0%)	157 (0%)
	All	119	118 (-0.1%)	118 (-0.5%)	119 (0%)	117 (-1.1%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-17. Steelhead Spawning WUA[a] in the Sacramento River, Segment 4, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
Nov	Wet	58	58 (0.3%)	59 (0.8%)	58 (0.3%)	59 (0.8%)
	Above Normal	54	54 (0%)	55 (1.2%)	54 (0%)	55 (0.6%)
	Below Normal	61	61 (-0.4%)	61 (-1.4%)	61 (-0.4%)	60 (-2.3%)
	Dry	63	64 (0.4%)	63 (-0.8%)	64 (0.6%)	63 (-0.8%)
	Critically Dry	64	65 (0.9%)	65 (0.6%)	65 (0.6%)	64 (0.1%)
	All	60	60 (0.3%)	60 (0.1%)	60 (0.3%)	60 (-0.3%)
December	Wet	52	52 (0.1%)	52 (0.1%)	52 (0.1%)	52 (0.2%)
	Above Normal	52	52 (-0.4%)	51 (-2%)	52 (-0.4%)	50 (-3.3%)
	Below Normal	50	50 (0.2%)	50 (-0.2%)	50 (0.2%)	48 (-2.4%)
	Dry	51	51 (0.5%)	52 (0.9%)	51 (0.5%)	50 (-2%)
	Critically Dry	63	63 (0.7%)	63 (0.6%)	63 (0.6%)	64 (1%)
	All	53	53 (0.2%)	53 (0%)	53 (0.2%)	53 (-1%)
January	Wet	30	30 (-0.1%)	30 (-0.1%)	30 (-0.1%)	30 (-0.1%)
	Above Normal	43	43 (0%)	43 (0%)	43 (0%)	43 (0%)
	Below Normal	59	59 (0%)	59 (0%)	59 (0%)	59 (0%)
	Dry	63	63 (-0.1%)	63 (-0.1%)	63 (-0.1%)	63 (-0.1%)
	Critically Dry	63	62 (-1.1%)	63 (0%)	63 (-0.1%)	63 (0.1%)
	All	49	49 (-0.3%)	49 (-0.1%)	49 (-0.1%)	49 (0%)
February	Wet	30	30 (-0.1%)	30 (-0.1%)	30 (-0.1%)	30 (-0.1%)
	Above Normal	34	33 (-1.4%)	33 (-2.6%)	33 (-1.6%)	32 (-6.2%)*
	Below Normal	51	52 (0.4%)	51 (-0.4%)	52 (0.5%)	51 (-0.1%)
	Dry	61	61 (-0.2%)	61 (-0.6%)	61 (-0.2%)	61 (-0.4%)
	Critically Dry	63	63 (0%)	63 (0%)	63 (0%)	63 (0%)
	All	46	46 (-0.2%)	46 (-0.6%)	46 (-0.2%)	46 (-0.8%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

11K.3.1.2. Feather River

Spring-run and Fall-run Chinook Salmon

Spring-run and fall-run are often difficult to distinguish in the Feather River, so a single WUA curve was developed for both runs (Payne and Allen 2004) (Figure 11K-7). The curve was used to compute spawning WUA with flows specific to the months of spawning for the run analyzed). To evaluate the effects of Alternatives 1–3 on spring-run spawning habitat in the Feather River,

the spawning WUA was estimated under Alternatives 1–3 and the NAA for CALSIM II flows below Thermalito Afterbay during September through November, the Feather River spring-run spawning period. The effects of Alternatives 1–3 on fall-run spawning habitat were estimated the same way except that flows during the October through December spawning periods for fall-run were used. Differences in spawning WUA between Alternatives 1–3 and the NAA for both runs were examined using the grand mean spawning WUA for each month of the spawning period under each water year type and all water year types combined (Table 11K-18 and Table 11K-19). In the tables of results, means that differed by >5% were highlighted in red for >5% reductions or green for >5% increases to flag the largest differences.

For both runs, the only differences >5% between Alternatives 1–3 and the NAA means were 6% to 7% reductions in October of below normal years under Alternatives 1A, 1B, and 2, but not under Alternative 3. These results suggest that Alternatives 1–3 have mostly minor effects on spring-run or fall-run spawning WUA in the High Flow Channel of the Feather River.

Table 11K-18. Spring-run Spawning WUA[a] in the Feather River Downstream of the Thermalito Afterbay Outlet and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
September	Wet	13	13 (-0.1%)	13 (0.1%)	13 (0.2%)	13 (0.1%)
	Above Normal	10	10 (0%)	10 (0.6%)	10 (0%)	10 (1.8%)
	Below Normal	27	27 (0.3%)	27 (-1.6%)	27 (0.3%)	27 (-1.9%)
	Dry	30	31 (2.3%)	31 (1.8%)	31 (2.9%)	31 (3.1%)
	Critically Dry	32	33 (2.7%)	33 (1.7%)	33 (1.8%)	32 (1.3%)
	All	22	22 (1.4%)	22 (0.6%)	22 (1.4%)	22 (1%)
October	Wet	21	21 (-2.4%)	21 (-2.3%)	21 (-2.5%)	20 (-3.2%)
	Above Normal	22	22 (0.3%)	22 (-1.2%)	22 (0.3%)	22 (-0.7%)
	Below Normal	33	31 (-6.8%)*	31 (-5.6%)*	31 (-6.7%)*	31 (-4.6%)
	Dry	32	32 (-0.7%)	32 (-0.5%)	31 (-1.5%)	32 (0%)
	Critically Dry	31	31 (0.8%)	31 (0.6%)	31 (1.1%)	31 (1.7%)
	All	27	26 (-2%)	26 (-1.9%)	26 (-2.2%)	27 (-1.5%)
November	Wet	30	30 (0%)	30 (0%)	30 (0%)	30 (0%)
	Above Normal	33	33 (0%)	33 (0.6%)	33 (0%)	33 (0.8%)
	Below Normal	35	34 (-1.4%)	34 (-1.4%)	34 (-1.5%)	34 (-1.3%)
	Dry	32	32 (-0.4%)	32 (0.5%)	32 (-0.3%)	32 (-0.3%)
	Critically Dry	29	30 (1%)	30 (0.8%)	30 (0.6%)	30 (0.5%)
	All	32	32 (-0.2%)	32 (0%)	32 (-0.3%)	32 (-0.1%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-19. Fall-run Spawning WUA[a] in the Feather River Downstream of the Thermalito Afterbay Outlet and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
October	Wet	21	21 (-2.4%)	21 (-2.3%)	21 (-2.5%)	20 (-3.2%)
	Above Normal	22	22 (0.3%)	22 (-1.2%)	22 (0.3%)	22 (-0.7%)
	Below Normal	33	31 (-6.8%)*	31 (-5.6%)*	31 (-6.7%)*	31 (-4.6%)
	Dry	32	32 (-0.7%)	32 (-0.5%)	31 (-1.5%)	32 (0%)
	Critically Dry	31	31 (0.8%)	31 (0.6%)	31 (1.1%)	31 (1.7%)
	All	27	26 (-2%)	26 (-1.9%)	26 (-2.2%)	27 (-1.5%)
November	Wet	30	30 (0%)	30 (0%)	30 (0%)	30 (0%)
	Above Normal	33	33 (0%)	33 (0.6%)	33 (0%)	33 (0.8%)
	Below Normal	35	34 (-1.4%)	34 (-1.4%)	34 (-1.5%)	34 (-1.3%)
	Dry	32	32 (-0.4%)	32 (0.5%)	32 (-0.3%)	32 (-0.3%)
	Critically Dry	29	30 (1%)	30 (0.8%)	30 (0.6%)	30 (0.5%)
	All	32	32 (-0.2%)	32 (0%)	32 (-0.3%)	32 (-0.1%)
December	Wet	24	24 (-0.1%)	24 (-0.2%)	24 (-0.4%)	24 (0.1%)
	Above Normal	27	28 (0.7%)	28 (0.7%)	28 (0.7%)	27 (-2%)
	Below Normal	33	33 (0.1%)	33 (0.1%)	33 (-0.1%)	33 (0.1%)
	Dry	31	30 (-0.7%)	30 (-0.8%)	30 (-0.7%)	31 (-0.3%)
	Critically Dry	28	28 (0%)	28 (0%)	28 (0%)	28 (0%)
	All	28	28 (-0.1%)	28 (-0.1%)	28 (-0.2%)	28 (-0.3%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Steelhead

To evaluate the effects of Alternatives 1–3 on steelhead spawning habitat, steelhead spawning WUA was computed from the steelhead spawning WUA curve for the Feather River (Payne and Allen 2004) (Figure 11K-8) for CALSIM II flows below Thermalito Afterbay under Alternatives 1–3 and the NAA during the December through March Feather River steelhead spawning period.

There are no differences greater than 5% between Alternatives 1–3 and the NAA in steelhead spawning WUA in the Feather River High Flow Channel (Table 11K-20). This result indicates that Alternatives 1–3 would have only minor effects of steelhead spawning WUA in the Feather River.

Table 11K-20. Steelhead Spawning WUA[a] in the Feather River Downstream of the Thermalito Afterbay Outlet and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
December	Wet	7	6 (-2.1%)	6 (-2.4%)	6 (-2.4%)	6 (-1.6%)
	Above Normal	7	7 (0.1%)	7 (0.1%)	7 (-0.1%)	7 (0.1%)
	Below Normal	9	9 (0%)	9 (0.1%)	9 (0%)	9 (0%)
	Dry	8	8 (0.1%)	8 (0.1%)	8 (0.1%)	8 (-1%)
	Critically Dry	9	9 (0.2%)	9 (0.2%)	9 (0.2%)	9 (0.2%)
	All	8	8 (-0.5%)	8 (-0.5%)	8 (-0.6%)	8 (-0.6%)
January	Wet	5	5 (0%)	5 (0%)	5 (0%)	5 (0%)
	Above Normal	9	9 (0%)	9 (0%)	9 (0%)	9 (-2.9%)
	Below Normal	10	10 (0.1%)	10 (-0.3%)	10 (0.1%)	10 (-0.2%)
	Dry	10	10 (-0.2%)	10 (-0.2%)	10 (-0.2%)	10 (-0.2%)
	Critically Dry	11	11 (-0.4%)	11 (0%)	11 (0%)	11 (0%)
	All	9	9 (-0.1%)	9 (-0.1%)	9 (-0.1%)	9 (-0.5%)
February	Wet	3	3 (0.1%)	3 (4.7%)	3 (0%)	3 (2.7%)
	Above Normal	7	7 (-0.4%)	7 (-0.4%)	7 (-0.4%)	7 (-0.5%)
	Below Normal	9	9 (0%)	9 (0%)	9 (0%)	9 (0%)
	Dry	10	10 (0%)	10 (0%)	10 (0%)	10 (0%)
	Critically Dry	11	11 (0%)	11 (0%)	11 (0%)	11 (0%)
	All	7	7 (0%)	7 (0.5%)	7 (-0.1%)	7 (0.3%)
March	Wet	2	2 (0%)	2 (0%)	2 (0%)	2 (0%)
	Above Normal	5	5 (1.9%)	5 (1.9%)	5 (1.8%)	5 (3.1%)
	Below Normal	10	10 (0%)	10 (0%)	10 (0%)	10 (0%)
	Dry	10	10 (0.1%)	10 (0.1%)	10 (0.1%)	10 (0%)
	Critically Dry	10	10 (0%)	10 (0.2%)	10 (0%)	10 (0.2%)
	All	7	7 (0.2%)	7 (0.3%)	7 (0.2%)	7 (0.4%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

11K.3.1.3. American River

The WUA curves used for fall-run Chinook salmon and steelhead spawning habitat in the American River (Figure 11K-9 and Figure 11K-10) were produced using data obtained from Bratovich et al. (2107), which provides composite spawning WUA tables for fall-run and steelhead downstream of Nimbus Dam.

Fall-run Chinook Salmon

To evaluate the effects of Alternatives 1–3 on fall-run spawning habitat in the American River, fall-run spawning WUA was estimated for CALSIM II flows at Nimbus Dam under the NAA and Alternatives 1–3 during the October through December spawning period using the composite fall-run spawning WUA curve (Figure 11K-9).

Differences in fall-run spawning WUA between Alternatives 1–3 and the NAA were examined using the grand mean spawning WUA for each month of the spawning period under each water year type and all water year types combined (Table 11K-21). In the tables of results, means that differed by >5% were highlighted in red for >5% reductions or green for >5% increases to flag the largest differences. The only difference in means >5% was a 7% reduction under Alternative 3 for November of above normal water years. These results indicate that Alternatives 1–3 would have only minor effects on fall-run spawning WUA in the American River.

Table 11K-21. Fall-run Spawning WUA[a] in the American River Downstream of Nimbus Dam and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
October	Wet	1856	1856 (0%)	1856 (0%)	1856 (0%)	1856 (0%)
	Above Normal	1878	1878 (0%)	1879 (0.1%)	1878 (0%)	1879 (0%)
	Below Normal	1786	1783 (-0.2%)	1790 (0.2%)	1782 (-0.2%)	1781 (-0.3%)
	Dry	1687	1676 (-0.6%)	1705 (1.1%)	1676 (-0.6%)	1736 (2.9%)
	Critically Dry	1504	1513 (0.6%)	1517 (0.9%)	1516 (0.8%)	1514 (0.7%)
	All	1758	1757 (-0.1%)	1765 (0.4%)	1757 (-0.1%)	1770 (0.7%)
November	Wet	1189	1178 (-0.9%)	1183 (-0.5%)	1178 (-0.9%)	1181 (-0.7%)
	Above Normal	1699	1692 (-0.4%)	1639 (-3.6%)	1691 (-0.5%)	1579 (-7.1%)*
	Below Normal	1577	1574 (-0.2%)	1561 (-1%)	1578 (0.1%)	1547 (-1.9%)
	Dry	1647	1642 (-0.3%)	1630 (-1%)	1641 (-0.4%)	1669 (1.3%)
	Critically Dry	1476	1456 (-1.4%)	1479 (0.2%)	1479 (0.2%)	1493 (1.1%)
	All	1472	1464 (-0.6%)	1456 (-1.1%)	1467 (-0.4%)	1454 (-1.2%)
December	Wet	1420	1422 (0.1%)	1419 (-0.1%)	1422 (0.1%)	1420 (-0.1%)
	Above Normal	1577	1578 (0.1%)	1575 (-0.1%)	1578 (0.1%)	1558 (-1.1%)
	Below Normal	1348	1351 (0.2%)	1342 (-0.4%)	1351 (0.2%)	1322 (-1.9%)
	Dry	1427	1453 (1.8%)	1445 (1.3%)	1451 (1.7%)	1447 (1.4%)
	Critically Dry	1468	1513 (3.1%)	1514 (3.2%)	1507 (2.7%)	1460 (-0.5%)
	All	1439	1453 (0.9%)	1448 (0.6%)	1452 (0.9%)	1435 (-0.3%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Steelhead

To evaluate the effects of Alternatives 1–3 on steelhead spawning habitat in the American River, steelhead spawning WUA was estimated for CALSIM II flows at Nimbus Dam under the NAA and Alternatives 1–3 during the December through March spawning period using the steelhead composite spawning WUA curve (Bratovich et al. 2107) (Figure 11K-10).

None of the differences in steelhead mean spawning WUA between Alternatives 1–3 and the NAA are greater than 5% and most are <1% (Table 11K-22). This result indicates that Alternatives 1–3 would have little effect on steelhead spawning WUA in the American River.

Table 11K-22. Steelhead Spawning WUA[a] in the American River Downstream of Nimbus Dam and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
December	Wet	1168	1170 (0.1%)	1167 (-0.1%)	1170 (0.1%)	1168 (-0.1%)
	Above Normal	1304	1305 (0.1%)	1303 (-0.1%)	1305 (0.1%)	1288 (-1.3%)
	Below Normal	1109	1112 (0.2%)	1104 (-0.5%)	1112 (0.2%)	1083 (-2.4%)
	Dry	1208	1229 (1.8%)	1220 (1%)	1228 (1.7%)	1220 (1%)
	Critically Dry	1274	1311 (2.9%)	1313 (3.1%)	1308 (2.7%)	1267 (-0.5%)
	All	1202	1213 (0.9%)	1209 (0.6%)	1213 (0.9%)	1197 (-0.5%)
January	Wet	523	524 (0.1%)	520 (-0.7%)	524 (0.1%)	513 (-2%)
	Above Normal	1008	1006 (-0.2%)	979 (-2.9%)	1006 (-0.2%)	975 (-3.3%)
	Below Normal	1336	1312 (-1.8%)	1309 (-2%)	1304 (-2.4%)	1321 (-1.1%)
	Dry	1487	1470 (-1.1%)	1470 (-1.1%)	1470 (-1.1%)	1480 (-0.5%)
	Critically Dry	1480	1473 (-0.5%)	1477 (-0.3%)	1473 (-0.5%)	1473 (-0.5%)
	All	1084	1075 (-0.8%)	1070 (-1.3%)	1074 (-0.9%)	1071 (-1.2%)
February	Wet	421	421 (0%)	421 (0%)	421 (0%)	421 (0%)
	Above Normal	701	701 (0%)	699 (-0.4%)	701 (0%)	699 (-0.4%)
	Below Normal	1010	1015 (0.5%)	1011 (0.1%)	1014 (0.4%)	1009 (-0.1%)
	Dry	1452	1442 (-0.7%)	1435 (-1.2%)	1433 (-1.3%)	1437 (-1.1%)
	Critically Dry	1526	1522 (-0.2%)	1522 (-0.2%)	1521 (-0.3%)	1526 (0%)
	All	951	949 (-0.2%)	946 (-0.5%)	947 (-0.4%)	947 (-0.4%)
March	Wet	860	860 (0%)	860 (0%)	860 (0%)	860 (0%)
	Above Normal	962	962 (0%)	962 (0%)	962 (0%)	962 (0%)
	Below Normal	1526	1526 (0%)	1527 (0%)	1526 (0%)	1526 (0%)
	Dry	1494	1501 (0.4%)	1502 (0.5%)	1500 (0.4%)	1491 (-0.2%)
	Critically Dry	1440	1445 (0.4%)	1433 (-0.5%)	1434 (-0.4%)	1441 (0.1%)
	All	1213	1215 (0.2%)	1213 (0.1%)	1213 (0%)	1212 (0%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.
^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

11K.3.2. Rearing Habitat Weighted Usable Area

11K.3.2.1. Sacramento River

Winter-run Chinook Salmon

Rearing habitat WUA provides an index of instream rearing habitat availability that takes into considerations the rearing requirements of fish with respect to water depth, flow velocity, and cover. Rearing WUA was separately determined for winter-run fry and juveniles by USFWS (2005b) for a range of flows in three segments of the Sacramento River between Keswick Dam and the Battle Creek confluence. The three river segments are the same as those described above for winter-run spawning habitat WUA: Segment 4 (Battle Creek to the confluence with Cow Creek), Segment 5 (Cow Creek to the ACID Dam), and Segment 6 (ACID Dam to Keswick Dam). To estimate changes in rearing WUA that would result from Alternatives 1–3 relative to the NAA, the fry and juvenile rearing habitat WUA curves developed for each of these segments was used with mean monthly CALSIM II flow estimates for corresponding segments of the river under Alternatives 1–3 and the NAA during the winter-run fry and juvenile rearing periods. For this analysis, fry are defined as fish less than 60 mm and juveniles are young fish (young-of-the-year) greater than 60 mm.

Differences in winter-run fry and juvenile rearing habitat WUA in each river segment under Alternatives 1–3 compared to the NAA were examined using the grand mean rearing WUA for each month of the fry (July through October) and juvenile (September through November) rearing periods under each water year type and all water year types combined (Table 11K-23 through Table 11K-28). In the tables of results, means that differed by >5% were highlighted in red for >5% reductions or green for >5% increases to flag the largest differences. All the means for fry rearing WUA differ by less than 5% between Alternatives 1–3 and the NAA in Segments 5 and 4 (Table 11K-24 and Table 11K-25). In Segment 6, three of the means under Alternatives 1–3 are >5% lower than the NAA mean (Table 11K-23). The largest reduction is 7% for October of below normal water years under Alternative 3. These results indicate that Alternative 3 would have a moderate negative effect on rearing habitat for winter-run fry in the Sacramento River during October of below normal years and the other alternatives would have little effect.

All the means for juvenile rearing WUA differ by <5% between Alternatives 1–3 and the NAA, except for a 5% increase in Segment 6 for October of critically dry years under Alternative 3 and a 5% reduction in Segment 4 for September of above normal years under Alternative 3 (Table 11K-26 and Table 11K-28). These results indicate that Alternatives 1–3 would have minor effects on rearing habitat for winter-run juveniles in the Sacramento River.

Table 11K-23. Winter-run Fry Rearing WUA[a] in the Sacramento River, Segment 6, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
July	Wet	73	74 (0.4%)	74 (0.4%)	74 (0.4%)	74 (0.4%)
	Above Normal	76	76 (-0.1%)	76 (0.1%)	76 (-0.1%)	76 (-0.7%)
	Below Normal	75	75 (0.1%)	75 (-0.2%)	75 (0.1%)	75 (0.3%)
	Dry	75	76 (1.5%)	76 (1.8%)	76 (1.6%)	75 (0.3%)
	Critically Dry	70	71 (0.5%)	71 (0.6%)	70 (0%)	70 (-0.3%)
	All	74	74 (0.5%)	74 (0.6%)	74 (0.5%)	74 (0.1%)
August	Wet	71	71 (0.2%)	71 (0.2%)	71 (0.2%)	71 (0.2%)
	Above Normal	68	68 (0%)	68 (0.2%)	68 (0%)	68 (1%)
	Below Normal	68	68 (0.1%)	68 (0.1%)	68 (0%)	68 (0.6%)
	Dry	70	69 (-1.3%)	69 (-1.3%)	69 (-1.3%)	70 (0.2%)
	Critically Dry	73	74 (1.3%)	74 (1.2%)	74 (1.1%)	73 (0.5%)
	All	70	70 (0%)	70 (0%)	70 (0%)	70 (0.4%)
September	Wet	69	69 (-0.1%)	69 (-0.1%)	69 (-0.1%)	69 (-0.1%)
	Above Normal	76	75 (-0.8%)	74 (-2.7%)	75 (-1.1%)	72 (-5.1%)*
	Below Normal	85	87 (1.5%)	87 (1.5%)	87 (2.1%)	86 (0.5%)
	Dry	91	90 (-0.8%)	91 (0.2%)	90 (-0.7%)	90 (-0.3%)
	Critically Dry	92	91 (-1.3%)	91 (-1.2%)	91 (-1.1%)	90 (-1.8%)
	All	81	81 (-0.3%)	81 (-0.2%)	81 (-0.1%)	80 (-1%)
October	Wet	82	82 (-0.3%)	81 (-0.8%)	82 (-0.5%)	80 (-2.2%)
	Above Normal	81	79 (-3.3%)	79 (-2.7%)	78 (-3.6%)	82 (0.8%)
	Below Normal	84	82 (-2.6%)	81 (-3.8%)	82 (-2.9%)	78 (-7.1%)*
	Dry	84	85 (0.9%)	85 (1%)	85 (1%)	80 (-4.1%)
	Critically Dry	88	84 (-4.8%)	85 (-3.8%)	83 (-5.1%)*	84 (-4.7%)
	All	84	82 (-1.5%)	82 (-1.6%)	82 (-1.7%)	81 (-3.4%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-24. Winter-run Fry Rearing WUA[a] in the Sacramento River, Segment 5, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
July	Wet	612	615 (0.4%)	615 (0.4%)	615 (0.4%)	615 (0.4%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	Above Normal	694	691 (-0.3%)	675 (-2.6%)	691 (-0.3%)	662 (-4.5%)
	Below Normal	643	649 (0.9%)	645 (0.3%)	649 (0.9%)	641 (-0.3%)
	Dry	594	604 (1.8%)	608 (2.4%)	604 (1.8%)	590 (-0.6%)
	Critically Dry	491	494 (0.6%)	494 (0.5%)	493 (0.3%)	488 (-0.7%)
	All	607	611 (0.7%)	609 (0.3%)	611 (0.7%)	602 (-0.8%)
August	Wet	536	537 (0.2%)	537 (0.2%)	537 (0.2%)	537 (0.2%)
	Above Normal	514	512 (-0.4%)	517 (0.5%)	512 (-0.4%)	490 (-4.7%)
	Below Normal	477	476 (-0.2%)	477 (-0.1%)	477 (-0.1%)	476 (-0.3%)
	Dry	468	474 (1.3%)	471 (0.5%)	474 (1.3%)	465 (-0.8%)
	Critically Dry	480	485 (1.1%)	480 (0.1%)	480 (0.1%)	479 (-0.1%)
	All	499	501 (0.4%)	501 (0.2%)	501 (0.3%)	495 (-0.8%)
September	Wet	509	509 (0%)	510 (0%)	509 (0%)	509 (0%)
	Above Normal	485	483 (-0.3%)	472 (-2.6%)	483 (-0.3%)	464 (-4.3%)
	Below Normal	550	549 (-0.1%)	546 (-0.7%)	550 (-0.1%)	543 (-1.3%)
	Dry	580	573 (-1.3%)	574 (-1%)	573 (-1.3%)	577 (-0.6%)
	Critically Dry	590	587 (-0.4%)	586 (-0.6%)	587 (-0.4%)	584 (-0.9%)
	All	541	538 (-0.4%)	537 (-0.8%)	538 (-0.4%)	535 (-1.1%)
October	Wet	512	512 (-0.1%)	510 (-0.4%)	512 (0%)	508 (-0.7%)
	Above Normal	513	508 (-1%)	512 (-0.2%)	508 (-1.1%)	515 (0.4%)
	Below Normal	527	523 (-0.8%)	521 (-1.1%)	522 (-0.8%)	519 (-1.5%)
	Dry	534	533 (-0.1%)	535 (0.2%)	533 (-0.1%)	526 (-1.5%)
	Critically Dry	551	542 (-1.7%)	549 (-0.5%)	543 (-1.5%)	538 (-2.5%)
	All	525	522 (-0.6%)	523 (-0.4%)	522 (-0.6%)	519 (-1.1%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-25. Winter-run Fry Rearing WUA[a] in the Sacramento River, Segment 4, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
July	Wet	123	122 (-0.2%)	122 (-0.2%)	122 (-0.2%)	122 (-0.2%)
	Above Normal	129	129 (0%)	130 (1.4%)	128 (0%)	130 (1.1%)
	Below Normal	125	124 (-0.2%)	125 (0.2%)	124 (-0.3%)	125 (0.3%)
	Dry	122	121 (-0.9%)	121 (-0.9%)	121 (-0.9%)	122 (0.4%)
	Critically Dry	131	131 (-0.1%)	131 (-0.1%)	131 (0%)	131 (0.5%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	All	125	124 (-0.3%)	125 (0%)	124 (-0.3%)	125 (0.3%)
August	Wet	125	125 (-0.1%)	125 (-0.1%)	125 (-0.1%)	125 (-0.1%)
	Above Normal	128	129 (0.3%)	128 (-0.2%)	129 (0.3%)	130 (1.5%)
	Below Normal	131	131 (0.1%)	131 (0%)	131 (0%)	131 (0.3%)
	Dry	133	132 (-0.6%)	132 (-0.5%)	132 (-0.6%)	134 (0.4%)
	Critically Dry	133	133 (-0.4%)	133 (-0.2%)	133 (-0.2%)	133 (0%)
	All	130	129 (-0.2%)	129 (-0.2%)	129 (-0.2%)	130 (0.3%)
September	Wet	129	129 (0%)	129 (0%)	129 (0%)	129 (0%)
	Above Normal	133	133 (0.3%)	134 (0.6%)	133 (0.3%)	134 (0.8%)
	Below Normal	131	131 (0.1%)	131 (0.2%)	131 (0.1%)	131 (0.2%)
	Dry	131	131 (0.2%)	131 (0%)	131 (0.2%)	131 (-0.1%)
	Critically Dry	132	131 (-0.7%)	131 (-0.7%)	131 (-0.6%)	132 (-0.4%)
	All	131	131 (0%)	131 (0%)	131 (0%)	131 (0.1%)
October	Wet	132	132 (0%)	132 (0%)	132 (0%)	132 (0%)
	Above Normal	132	132 (0%)	132 (-0.2%)	132 (-0.3%)	131 (-0.4%)
	Below Normal	132	132 (-0.1%)	132 (-0.1%)	132 (-0.1%)	132 (0%)
	Dry	131	132 (0.1%)	131 (0%)	131 (0.1%)	132 (0.2%)
	Critically Dry	132	132 (0.1%)	132 (0.1%)	132 (0.1%)	131 (-0.2%)
	All	132	132 (0%)	132 (-0.1%)	132 (0%)	132 (0%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-26. Winter-run Juvenile WUA[a] in the Sacramento River, Segment 6 and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
September	Wet	40	40 (-0.2%)	40 (-0.2%)	40 (-0.2%)	40 (-0.2%)
	Above Normal	42	42 (0.7%)	42 (1.3%)	42 (0.7%)	43 (2.5%)
	Below Normal	39	39 (0.9%)	39 (1.6%)	39 (0.8%)	39 (0.7%)
	Dry	36	36 (-0.2%)	37 (1.3%)	36 (-0.2%)	36 (0.6%)
	Critically Dry	35	35 (1.3%)	35 (1.5%)	35 (1.1%)	35 (1.2%)
	All	38	38 (0.3%)	39 (0.9%)	38 (0.3%)	39 (0.7%)
October	Wet	40	40 (0.3%)	40 (0.7%)	40 (0.3%)	40 (-0.3%)
	Above Normal	40	40 (-0.8%)	40 (-0.4%)	40 (-0.8%)	40 (-0.1%)
	Below Normal	40	40 (0.7%)	40 (0.8%)	40 (0.8%)	40 (1.1%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	Dry	39	38 (-1.8%)	39 (-1.1%)	38 (-1.8%)	39 (0%)
	Critically Dry	36	37 (3.1%)	37 (1.5%)	37 (2.5%)	38 (5.4%)^
	All	39	39 (0.1%)	39 (0.3%)	39 (0.1%)	39 (0.8%)
November	Wet	30	30 (0.5%)	30 (0.5%)	30 (0.4%)	30 (-0.2%)
	Above Normal	31	31 (0.1%)	32 (2.4%)	31 (0%)	32 (3.7%)
	Below Normal	31	31 (0.2%)	31 (0.1%)	30 (-0.9%)	30 (-0.3%)
	Dry	31	31 (0%)	31 (-0.6%)	31 (0.1%)	31 (-0.2%)
	Critically Dry	32	31 (-0.8%)	32 (1.4%)	31 (-0.7%)	32 (1.5%)
	All	31	31 (0.1%)	31 (0.6%)	31 (-0.1%)	31 (0.6%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-27. Winter-run Juvenile WUA[a] in the Sacramento River, Segment 5 and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
September	Wet	195	195 (0%)	195 (0%)	195 (0%)	195 (0%)
	Above Normal	205	205 (-0.2%)	203 (-1.1%)	205 (-0.2%)	201 (-2%)
	Below Normal	218	217 (-0.2%)	216 (-0.5%)	217 (-0.2%)	216 (-0.6%)
	Dry	224	223 (-0.4%)	223 (-0.6%)	223 (-0.4%)	223 (-0.3%)
	Critically Dry	227	226 (-0.3%)	226 (-0.4%)	226 (-0.3%)	226 (-0.3%)
	All	212	211 (-0.2%)	211 (-0.4%)	211 (-0.2%)	211 (-0.5%)
October	Wet	212	212 (-0.1%)	211 (-0.3%)	212 (-0.1%)	211 (-0.2%)
	Above Normal	212	212 (0%)	212 (0.1%)	212 (0%)	212 (-0.2%)
	Below Normal	214	214 (-0.2%)	214 (-0.2%)	214 (-0.2%)	214 (-0.2%)
	Dry	215	216 (0.1%)	216 (0.1%)	216 (0.1%)	215 (-0.3%)
	Critically Dry	219	217 (-0.8%)	218 (-0.2%)	218 (-0.6%)	216 (-1.5%)
	All	214	214 (-0.1%)	214 (-0.1%)	214 (-0.1%)	213 (-0.4%)
November	Wet	219	219 (-0.1%)	218 (-0.4%)	219 (-0.1%)	219 (0.1%)
	Above Normal	215	215 (-0.2%)	213 (-0.8%)	215 (-0.2%)	213 (-1.1%)
	Below Normal	218	218 (-0.2%)	218 (-0.2%)	218 (-0.1%)	218 (-0.1%)
	Dry	215	216 (0.2%)	216 (0.4%)	216 (0.2%)	216 (0.2%)
	Critically Dry	217	217 (-0.1%)	215 (-0.7%)	217 (-0.1%)	215 (-1%)
	All	217	217 (-0.1%)	216 (-0.3%)	217 (-0.1%)	216 (-0.3%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.
^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-28. Winter-run Juvenile WUA[a] in the Sacramento River, Segment 4 and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
September	Wet	55	55 (0%)	55 (0%)	55 (0%)	55 (0%)
	Above Normal	60	60 (-0.4%)	58 (-3%)	60 (-0.4%)	57 (-5.1%)*
	Below Normal	72	71 (-0.2%)	71 (-0.5%)	71 (-0.2%)	71 (-1.3%)
	Dry	75	74 (-1.2%)	74 (-0.7%)	74 (-1.2%)	74 (-0.6%)
	Critically Dry	76	75 (-1.1%)	75 (-1.1%)	75 (-1%)	75 (-1%)
	All	66	66 (-0.6%)	66 (-0.8%)	66 (-0.6%)	65 (-1.2%)
October	Wet	64	64 (-0.1%)	64 (-0.7%)	64 (-0.1%)	63 (-1.4%)
	Above Normal	65	65 (-1.3%)	65 (-0.1%)	65 (-1.1%)	65 (-0.2%)
	Below Normal	67	66 (-1.1%)	66 (-1.6%)	66 (-1.2%)	66 (-2.2%)
	Dry	68	68 (-0.3%)	68 (0.3%)	68 (-0.2%)	67 (-1.4%)
	Critically Dry	71	70 (-1.3%)	70 (-0.4%)	70 (-1.2%)	69 (-2.5%)
	All	67	66 (-0.7%)	66 (-0.5%)	66 (-0.6%)	66 (-1.5%)
November	Wet	64	64 (-0.2%)	64 (-0.5%)	64 (-0.2%)	64 (0%)
	Above Normal	65	65 (-0.3%)	64 (-2.3%)	65 (-0.2%)	63 (-3%)
	Below Normal	68	68 (-0.3%)	68 (0%)	68 (0.5%)	68 (0.3%)
	Dry	66	66 (0.2%)	66 (0.9%)	66 (0.2%)	66 (0.4%)
	Critically Dry	68	68 (1.1%)	67 (-0.6%)	68 (0.8%)	67 (-0.7%)
	All	66	66 (0.1%)	66 (-0.4%)	66 (0.2%)	66 (-0.4%)

[a] WUA results are given in thousands of WUA units to save space.
* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.
^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Spring-run Chinook Salmon

Rearing habitat WUA for spring-run was not estimated directly, but was modeled using the fry and juvenile rearing habitat WUA curves obtained for fall-run Chinook salmon in Segments 4, 5 and 6 (U.S. Fish and Wildlife Service 2005b). The validity of using the fall-run Chinook salmon rearing WUA curves to characterize spring-run Chinook salmon rearing habitat is uncertain (U.S. Fish and Wildlife Service 2005b).

Rearing WUA in the Sacramento River was separately determined for spring-run fry and juveniles for a range of flows in Segments 4, 5 and 6. To estimate changes in rearing WUA that would result from Alternatives 1–3 relative to the NAA, the fry and juvenile rearing habitat WUA curves developed for each of these segments were used with mean monthly CALSIM II

flow estimates for the corresponding segments of the river under Alternatives 1–3 and the NAA during the spring-run fry and juvenile rearing periods.

Differences in spring-run fry and juvenile rearing habitat WUA in each river segment under Alternatives 1–3 compared to the NAA were examined using the grand mean rearing WUA for each month of the fry (November through February) and juvenile (year-round) rearing periods under each water year type and all water year types combined (Table 11K-29 through Table 11K-34). In the tables of results, means that differed by >5% were highlighted in red for >5% reductions or green for >5% increases to flag the largest differences. All the means for fry rearing WUA differ by less than 5% between Alternatives 1–3 and the NAA in Segments 6 and 4 (Table 11K-29 and Table 11K-31), and only one mean in Segment 5 (November of above normal years under Alternative 3) is >5% different (lower) than the NAA mean (Table 11K-30). These results indicate that Alternatives 1–3 would have minor effects on rearing habitat for spring-run fry in the Sacramento River.

Because some rearing by spring-run juveniles occurs throughout the year, all months are included in the spring-run juvenile rearing WUA analysis (Table 11K-32 through Table 11K-34). In Segment 6, a few of the means for Alternatives 1–3 differed from the NAA means by more than 5%, and all the differences resulted from increased rearing WUA under Alternatives 1–3 (Table 11K-32). Four of the five increases occur under Alternative 3. The pattern for >5% difference in Segment 5 is similar to that in Segment 6, but in Segment 5 all of the differences occur under Alternative 3 and one of them (September of above normal years) results from reduced rearing WUA under Alternative 3 (Table 11K-33). Segment 4 has many more large differences in juvenile rearing WUA than either of the other segments (Table 11K-34). Almost all of these differences occur under Alternatives 1B and 3 and include some relatively large differences (including a 17% increase for Alternative 3 in August of above normal years and 17% reduction for Alternative 3 in September of above normal years). Increases >5% in rearing WUA outnumber reductions >5%, with all increases occurring in the spring and summer months and all reductions occurring in the fall (Table 11K-34).

The results for spring-run juvenile rearing WUA indicate that Alternatives 1–3 would generally have minor effects on rearing habitat in Segments 6 and 5, but Alternatives 1B and 3 would have some large effects in Segment 4, including substantial increases in rearing WUA during spring and summer and substantial reductions in rearing WUA during the fall. Increases in WUA outnumber reductions in the results and more of them are especially large (>10%). Furthermore, the increases occur during spring and summer, when the juveniles are younger and perhaps more vulnerable to reductions in habitat availability. On balance, Alternatives 1–3 are expected to have a negligible effect on spring-run rearing habitat WUA.

Table 11K-29. Spring-run Fry Rearing WUA[a] in the Sacramento River, Segment 6, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
November	Wet	63	63 (-0.5%)	63 (-1.1%)	63 (-0.5%)	63 (-1.1%)
	Above Normal	60	60 (0.2%)	59 (-0.2%)	60 (0.2%)	60 (0%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	Below Normal	61	62 (1.2%)	61 (0.6%)	61 (0.8%)	61 (0.4%)
	Dry	61	62 (0.2%)	62 (0.3%)	61 (0.1%)	62 (0.6%)
	Critically Dry	62	61 (-1.1%)	61 (-1.3%)	61 (-1.3%)	60 (-2.4%)
	All	62	62 (0%)	61 (-0.4%)	62 (-0.2%)	61 (-0.5%)
December	Wet	75	75 (-0.4%)	75 (-0.4%)	75 (-0.4%)	75 (-0.6%)
	Above Normal	65	65 (0.1%)	65 (0%)	65 (0.2%)	65 (0.8%)
	Below Normal	70	69 (-0.3%)	69 (-0.4%)	69 (-0.4%)	70 (-0.1%)
	Dry	65	65 (-0.3%)	64 (-1%)	65 (-0.4%)	65 (-0.8%)
	Critically Dry	68	67 (-1%)	67 (-0.6%)	67 (-0.7%)	67 (-1.6%)
	All	69	69 (-0.4%)	69 (-0.5%)	69 (-0.3%)	69 (-0.5%)
January	Wet	77	77 (0.1%)	77 (-0.1%)	77 (0.2%)	77 (-0.1%)
	Above Normal	69	69 (0%)	69 (0%)	69 (0%)	69 (0%)
	Below Normal	68	68 (0%)	68 (0.3%)	68 (0%)	68 (0.3%)
	Dry	71	72 (0.4%)	72 (0.4%)	72 (0.4%)	72 (0.4%)
	Critically Dry	70	70 (0.2%)	70 (0%)	70 (0.2%)	70 (-0.2%)
	All	72	72 (0.1%)	72 (0.1%)	72 (0.2%)	72 (0.1%)
February	Wet	79	79 (0%)	79 (0%)	79 (0%)	79 (0%)
	Above Normal	76	76 (-0.3%)	76 (-0.4%)	76 (-0.3%)	76 (0%)
	Below Normal	68	67 (-1.5%)	68 (-0.3%)	67 (-0.8%)	67 (-1.9%)
	Dry	71	71 (0.6%)	71 (0.7%)	71 (0.6%)	71 (0.2%)
	Critically Dry	70	70 (0.8%)	70 (0.8%)	70 (0.8%)	70 (0.9%)
	All	74	74 (-0.1%)	74 (0.1%)	74 (0%)	73 (-0.1%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-30. Spring-run Fry Rearing WUA[a] in the Sacramento River, Segment 5, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
November	Wet	1148	1143 (-0.4%)	1133 (-1.3%)	1143 (-0.4%)	1147 (0%)
	Above Normal	1131	1125 (-0.5%)	1088 (-3.7%)	1127 (-0.3%)	1070 (-5.3%)*
	Below Normal	1173	1167 (-0.5%)	1173 (0%)	1178 (0.4%)	1179 (0.5%)
	Dry	1146	1150 (0.3%)	1157 (0.9%)	1150 (0.3%)	1148 (0.2%)
	Critically Dry	1131	1136 (0.5%)	1099 (-2.9%)	1135 (0.4%)	1088 (-3.8%)
	All	1147	1145 (-0.1%)	1134 (-1.2%)	1147 (0%)	1133 (-1.2%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
December	Wet	1086	1083 (-0.2%)	1089 (0.3%)	1083 (-0.2%)	1071 (-1.3%)
	Above Normal	1297	1297 (0%)	1298 (0.1%)	1298 (0.1%)	1315 (1.4%)
	Below Normal	1391	1392 (0.1%)	1390 (0%)	1391 (0.1%)	1393 (0.2%)
	Dry	1319	1315 (-0.3%)	1292 (-2%)	1315 (-0.3%)	1259 (-4.5%)
	Critically Dry	1409	1415 (0.4%)	1406 (-0.2%)	1403 (-0.4%)	1397 (-0.8%)
	All	1267	1267 (0%)	1262 (-0.4%)	1265 (-0.2%)	1251 (-1.3%)
January	Wet	1080	1082 (0.1%)	1082 (0.2%)	1082 (0.1%)	1082 (0.2%)
	Above Normal	1203	1203 (0%)	1203 (0%)	1203 (0%)	1203 (0%)
	Below Normal	1351	1351 (0%)	1357 (0.4%)	1352 (0%)	1356 (0.3%)
	Dry	1444	1444 (0%)	1444 (0%)	1444 (0%)	1444 (0%)
	Critically Dry	1412	1402 (-0.7%)	1413 (0.1%)	1411 (-0.1%)	1421 (0.7%)
	All	1273	1272 (-0.1%)	1275 (0.1%)	1273 (0%)	1276 (0.2%)
February	Wet	1097	1096 (-0.1%)	1096 (-0.1%)	1096 (-0.1%)	1096 (-0.1%)
	Above Normal	1150	1150 (-0.1%)	1150 (0%)	1150 (0%)	1157 (0.6%)
	Below Normal	1236	1237 (0.1%)	1224 (-1%)	1243 (0.6%)	1210 (-2.1%)
	Dry	1444	1445 (0.1%)	1446 (0.1%)	1445 (0.1%)	1444 (0%)
	Critically Dry	1452	1458 (0.4%)	1454 (0.2%)	1455 (0.3%)	1458 (0.5%)
	All	1256	1258 (0.1%)	1255 (-0.1%)	1258 (0.1%)	1254 (-0.2%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-31. Spring-run Fry Rearing WUA[a] in the Sacramento River, Segment 4, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
November	Wet	183	182 (-0.4%)	182 (-0.8%)	182 (-0.4%)	182 (-0.6%)
	Above Normal	185	186 (0.3%)	184 (-0.7%)	186 (0.3%)	183 (-1.2%)
	Below Normal	191	191 (0.4%)	191 (0.3%)	192 (0.6%)	191 (0.5%)
	Dry	189	189 (-0.2%)	189 (0%)	189 (-0.3%)	190 (0.3%)
	Critically Dry	196	194 (-1%)	191 (-2.2%)	194 (-1%)	189 (-3.5%)
	All	188	188 (-0.2%)	187 (-0.6%)	188 (-0.2%)	187 (-0.7%)
December	Wet	159	158 (-0.1%)	159 (0.2%)	158 (-0.1%)	158 (-0.4%)
	Above Normal	183	183 (-0.4%)	183 (-0.3%)	183 (-0.3%)	184 (0%)
	Below Normal	203	203 (-0.3%)	202 (-0.5%)	202 (-0.3%)	203 (0%)
	Dry	197	196 (-0.5%)	195 (-0.9%)	196 (-0.5%)	195 (-1%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	Critically Dry	217	216 (-0.3%)	216 (-0.5%)	215 (-0.7%)	213 (-1.6%)
	All	187	186 (-0.3%)	186 (-0.4%)	186 (-0.4%)	186 (-0.6%)
January	Wet	154	155 (0.1%)	155 (0.2%)	155 (0.1%)	155 (0.2%)
	Above Normal	161	161 (0%)	161 (0%)	161 (0%)	161 (0%)
	Below Normal	189	189 (0%)	189 (0.2%)	189 (0%)	189 (0.1%)
	Dry	207	208 (0.1%)	208 (0.1%)	208 (0.1%)	208 (0.2%)
	Critically Dry	213	212 (-0.2%)	213 (0%)	212 (-0.1%)	213 (0.2%)
	All	181	181 (0%)	182 (0.1%)	181 (0.1%)	182 (0.1%)
February	Wet	156	156 (0%)	156 (0%)	156 (0%)	156 (0%)
	Above Normal	155	155 (0.2%)	155 (0.3%)	155 (0.3%)	152 (-1.5%)
	Below Normal	175	175 (0.2%)	175 (0%)	175 (0%)	174 (-0.3%)
	Dry	197	198 (0.5%)	198 (0.8%)	198 (0.5%)	198 (0.3%)
	Critically Dry	212	212 (0.3%)	212 (0.2%)	212 (0.2%)	212 (0.3%)
	All	176	177 (0.2%)	177 (0.3%)	177 (0.2%)	176 (-0.1%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-32. Spring-run Juvenile Rearing WUA[a] in the Sacramento River, Segment 6, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
January	Wet	28	28 (0.3%)	28 (0.3%)	28 (0.3%)	28 (0.2%)
	Above Normal	28	28 (-0.1%)	28 (-0.1%)	28 (-0.1%)	28 (-0.1%)
	Below Normal	32	32 (0%)	32 (0.2%)	32 (0%)	32 (0.2%)
	Dry	34	34 (0.3%)	34 (0.3%)	34 (0.3%)	34 (0.3%)
	Critically Dry	34	33 (-0.7%)	34 (-0.1%)	33 (-0.3%)	33 (-0.6%)
	All	31	31 (0%)	31 (0.2%)	31 (0.1%)	31 (0.1%)
February	Wet	29	29 (-0.1%)	29 (-0.1%)	29 (-0.1%)	29 (-0.1%)
	Above Normal	29	28 (-0.9%)	28 (-1.7%)	28 (-1%)	28 (-3.1%)
	Below Normal	29	28 (-0.8%)	29 (-0.2%)	29 (-0.2%)	28 (-1.5%)
	Dry	33	34 (0.6%)	34 (0.3%)	34 (0.6%)	33 (-0.1%)
	Critically Dry	33	33 (0.8%)	33 (0.8%)	33 (0.8%)	33 (0.8%)
	All	31	31 (0%)	30 (-0.1%)	31 (0.1%)	30 (-0.6%)
March	Wet	26	26 (0%)	26 (0%)	26 (0%)	26 (0%)
	Above Normal	26	26 (-0.2%)	26 (-0.5%)	26 (-0.2%)	26 (-0.5%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	Below Normal	32	32 (0%)	32 (0%)	32 (0%)	32 (0%)
	Dry	33	33 (0.8%)	33 (0.8%)	33 (0.8%)	32 (-0.3%)
	Critically Dry	33	32 (-0.2%)	33 (-0.1%)	32 (-0.2%)	32 (-0.2%)
	All	29	29 (0.1%)	29 (0.1%)	29 (0.1%)	29 (-0.2%)
April	Wet	39	38 (-1.5%)	38 (-1.5%)	38 (-1.5%)	38 (-1.5%)
	Above Normal	43	42 (-1.5%)	42 (-2.8%)	42 (-1.5%)	42 (-2.8%)
	Below Normal	44	44 (0%)	44 (0.3%)	44 (0%)	45 (1.8%)
	Dry	43	43 (0.4%)	44 (0.7%)	43 (0.4%)	44 (0.7%)
	Critically Dry	43	44 (0.9%)	45 (3%)	44 (1%)	43 (0.6%)
	All	42	42 (-0.4%)	42 (-0.2%)	42 (-0.4%)	42 (-0.3%)
May	Wet	37	37 (0%)	37 (0%)	37 (0%)	37 (0%)
	Above Normal	39	39 (-0.3%)	39 (-0.3%)	39 (-0.3%)	39 (-0.3%)
	Below Normal	42	42 (0.3%)	42 (1%)	42 (0.3%)	42 (0.3%)
	Dry	41	42 (0.9%)	42 (0.9%)	42 (0.9%)	42 (1.7%)
	Critically Dry	42	42 (2%)	43 (2.3%)	42 (2%)	43 (3.7%)
	All	40	40 (0.5%)	40 (0.7%)	40 (0.5%)	40 (1%)
June	Wet	40	40 (0.1%)	40 (0.1%)	40 (0.1%)	40 (0.1%)
	Above Normal	37	37 (0.2%)	39 (5.2%)^	37 (0.2%)	39 (7%)^
	Below Normal	36	36 (0.4%)	37 (1.6%)	36 (0.4%)	38 (5.2%)^
	Dry	34	35 (2.2%)	35 (2.1%)	35 (2.2%)	35 (3%)
	Critically Dry	38	38 (-0.2%)	39 (0.7%)	38 (-0.1%)	39 (0.6%)
	All	37	38 (0.5%)	38 (1.6%)	38 (0.5%)	38 (2.6%)
July	Wet	31	31 (-0.6%)	31 (-0.6%)	31 (-0.6%)	31 (-0.6%)
	Above Normal	30	31 (0.4%)	32 (3.9%)	31 (0.4%)	32 (6.1%)^
	Below Normal	31	31 (-0.6%)	31 (0.5%)	31 (-0.6%)	31 (1.4%)
	Dry	31	31 (-1.1%)	31 (-1.9%)	31 (-1.1%)	31 (0%)
	Critically Dry	37	37 (-0.4%)	37 (-0.3%)	37 (-0.3%)	37 (0.1%)
	All	32	32 (-0.6%)	32 (-0.1%)	32 (-0.5%)	32 (0.8%)
August	Wet	34	34 (-0.1%)	34 (-0.1%)	34 (-0.1%)	34 (-0.1%)
	Above Normal	34	34 (0.5%)	34 (-0.3%)	34 (0.5%)	37 (7.4%)^
	Below Normal	37	37 (0.2%)	37 (0.2%)	37 (0.1%)	38 (0.8%)
	Dry	39	38 (-1.7%)	39 (-1.3%)	38 (-1.8%)	39 (0.6%)
	Critically Dry	41	41 (0.5%)	41 (-0.1%)	41 (-0.2%)	41 (0%)
	All	37	37 (-0.3%)	37 (-0.4%)	36 (-0.4%)	37 (1.2%)
September	Wet	36	36 (-0.1%)	35 (-0.1%)	36 (-0.1%)	36 (-0.1%)
	Above Normal	41	41 (0.2%)	41 (-0.5%)	41 (0.2%)	40 (-2.4%)
	Below Normal	44	44 (0%)	43 (-3%)	44 (-0.2%)	43 (-3.9%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	Dry	46	46 (0.6%)	47 (1.2%)	46 (0.5%)	46 (-0.1%)
	Critically Dry	41	42 (2.1%)	42 (2.4%)	42 (1.8%)	43 (3.6%)
	All	41	41 (0.5%)	41 (0%)	41 (0.4%)	41 (-0.5%)
October	Wet	42	43 (2.1%)	43 (2.5%)	42 (1.6%)	42 (0.1%)
	Above Normal	43	43 (0.8%)	45 (3.4%)	43 (0.6%)	42 (-2.2%)
	Below Normal	42	42 (0.3%)	42 (0.4%)	42 (0.3%)	43 (0.8%)
	Dry	45	45 (0.5%)	45 (0.2%)	45 (0.4%)	45 (1%)
	Critically Dry	42	43 (2.2%)	43 (1.8%)	43 (2.3%)	44 (4.3%)
	All	43	43 (1.2%)	43 (1.7%)	43 (1%)	43 (0.7%)
November	Wet	29	28 (-0.4%)	28 (-1.4%)	28 (-0.4%)	28 (-1.2%)
	Above Normal	28	28 (-0.2%)	28 (-0.3%)	28 (-0.1%)	28 (-0.9%)
	Below Normal	29	29 (0.7%)	29 (0.9%)	29 (0.3%)	29 (0.6%)
	Dry	29	29 (0.5%)	29 (0.5%)	29 (0.5%)	29 (1%)
	Critically Dry	29	29 (-0.6%)	29 (-1.2%)	29 (-0.6%)	29 (-2.4%)
	All	29	29 (0%)	29 (-0.4%)	29 (-0.1%)	29 (-0.5%)
December	Wet	27	27 (-0.6%)	27 (-0.3%)	27 (-0.6%)	26 (-1.7%)
	Above Normal	29	29 (-0.2%)	29 (-0.2%)	29 (-0.2%)	29 (0.3%)
	Below Normal	32	32 (-0.1%)	32 (-0.2%)	32 (-0.2%)	32 (0%)
	Dry	31	31 (-0.1%)	31 (-1.2%)	31 (-0.1%)	31 (-2.3%)
	Critically Dry	32	32 (-0.4%)	32 (0%)	32 (-0.2%)	32 (-0.5%)
	All	30	30 (-0.3%)	30 (-0.4%)	30 (-0.3%)	30 (-1.1%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-33. Spring-run Juvenile Rearing WUA[a] in the Sacramento River, Segment 5, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
January	Wet	361	362 (0.1%)	362 (0.1%)	362 (0.1%)	362 (0.1%)
	Above Normal	420	420 (0%)	420 (0%)	420 (0%)	420 (0%)
	Below Normal	487	487 (0%)	487 (0.1%)	487 (0%)	487 (0%)
	Dry	509	510 (0.1%)	510 (0.1%)	510 (0.1%)	510 (0.1%)
	Critically Dry	506	503 (-0.5%)	506 (0%)	506 (0%)	507 (0.3%)
	All	445	445 (0%)	445 (0.1%)	445 (0.1%)	445 (0.1%)
February	Wet	364	363 (-0.1%)	363 (-0.1%)	363 (-0.1%)	363 (-0.1%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	Above Normal	383	381 (-0.6%)	379 (-1.2%)	381 (-0.7%)	375 (-2.1%)
	Below Normal	441	440 (-0.1%)	438 (-0.6%)	443 (0.4%)	433 (-1.8%)
	Dry	508	510 (0.3%)	508 (0.1%)	510 (0.3%)	508 (-0.1%)
	Critically Dry	512	513 (0.2%)	513 (0.1%)	513 (0.2%)	514 (0.3%)
	All	433	433 (0%)	432 (-0.3%)	433 (0.1%)	431 (-0.6%)
March	Wet	366	366 (0%)	366 (0%)	366 (0%)	366 (0%)
	Above Normal	388	387 (-0.1%)	386 (-0.4%)	387 (-0.1%)	386 (-0.4%)
	Below Normal	489	489 (0%)	489 (0%)	489 (0%)	489 (0%)
	Dry	493	495 (0.3%)	494 (0.1%)	495 (0.3%)	492 (-0.4%)
	Critically Dry	495	494 (-0.3%)	495 (0%)	494 (-0.3%)	496 (0.2%)
	All	437	437 (0%)	437 (0%)	437 (0%)	436 (-0.1%)
April	Wet	419	420 (0.2%)	420 (0.2%)	420 (0.2%)	420 (0.2%)
	Above Normal	463	463 (-0.1%)	461 (-0.4%)	463 (-0.1%)	461 (-0.4%)
	Below Normal	498	499 (0.2%)	498 (0.1%)	499 (0.2%)	496 (-0.3%)
	Dry	492	493 (0.3%)	496 (0.8%)	493 (0.3%)	496 (0.9%)
	Critically Dry	498	497 (-0.3%)	497 (-0.2%)	497 (-0.3%)	501 (0.5%)
	All	467	467 (0.1%)	467 (0.2%)	467 (0.1%)	468 (0.2%)
May	Wet	362	362 (-0.1%)	362 (-0.1%)	362 (-0.1%)	362 (-0.1%)
	Above Normal	379	380 (0.5%)	381 (0.5%)	380 (0.5%)	381 (0.5%)
	Below Normal	406	410 (0.9%)	417 (2.7%)	410 (0.9%)	417 (2.6%)
	Dry	399	404 (1.3%)	407 (2%)	404 (1.3%)	411 (3%)
	Critically Dry	399	416 (4.5%)	418 (4.8%)	417 (4.5%)	419 (5%)^
	All	386	390 (1.2%)	392 (1.7%)	390 (1.2%)	393 (2%)
June	Wet	374	375 (0.4%)	375 (0.4%)	375 (0.4%)	375 (0.4%)
	Above Normal	347	348 (0.3%)	362 (4.4%)	348 (0.3%)	368 (6.2%)^
	Below Normal	347	349 (0.6%)	353 (1.8%)	349 (0.6%)	364 (5.1%)^
	Dry	336	340 (1.3%)	339 (0.8%)	340 (1.3%)	342 (1.9%)
	Critically Dry	363	362 (-0.1%)	364 (0.4%)	362 (0%)	363 (0.2%)
	All	355	357 (0.5%)	360 (1.3%)	357 (0.5%)	363 (2.3%)
July	Wet	311	310 (-0.3%)	310 (-0.3%)	310 (-0.3%)	310 (-0.3%)
	Above Normal	299	300 (0.1%)	306 (2.3%)	300 (0.1%)	311 (3.9%)
	Below Normal	307	306 (-0.4%)	308 (0.2%)	306 (-0.4%)	309 (0.6%)
	Dry	315	314 (-0.4%)	312 (-0.9%)	314 (-0.4%)	316 (0.3%)
	Critically Dry	356	355 (-0.2%)	356 (-0.1%)	356 (-0.2%)	356 (-0.2%)
	All	316	315 (-0.3%)	316 (0%)	315 (-0.3%)	318 (0.6%)
August	Wet	330	330 (0%)	330 (0%)	330 (0%)	330 (0%)
	Above Normal	333	334 (0.3%)	332 (-0.2%)	334 (0.3%)	351 (5.4%)^

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	Below Normal	353	354 (0.2%)	354 (0.2%)	354 (0.1%)	356 (0.8%)
	Dry	368	364 (-1.3%)	364 (-1.1%)	364 (-1.3%)	370 (0.3%)
	Critically Dry	387	390 (0.8%)	386 (-0.2%)	386 (-0.2%)	387 (0%)
	All	351	351 (-0.1%)	350 (-0.3%)	350 (-0.3%)	355 (0.9%)
September	Wet	345	345 (0%)	344 (-0.1%)	345 (0%)	345 (0%)
	Above Normal	389	389 (-0.2%)	380 (-2.5%)	388 (-0.3%)	370 (-5.1%)*
	Below Normal	452	451 (-0.1%)	449 (-0.6%)	451 (0%)	446 (-1.2%)
	Dry	480	475 (-1%)	475 (-1%)	475 (-1%)	477 (-0.6%)
	Critically Dry	492	487 (-1.1%)	486 (-1.2%)	487 (-1%)	487 (-1%)
	All	421	419 (-0.5%)	417 (-0.9%)	419 (-0.5%)	416 (-1.2%)
October	Wet	421	420 (-0.2%)	417 (-0.9%)	420 (-0.2%)	416 (-1.1%)
	Above Normal	424	422 (-0.4%)	424 (0.1%)	421 (-0.6%)	422 (-0.5%)
	Below Normal	434	430 (-0.8%)	429 (-1.1%)	430 (-0.8%)	428 (-1.4%)
	Dry	439	439 (0%)	440 (0.3%)	440 (0.1%)	434 (-1%)
	Critically Dry	457	450 (-1.5%)	455 (-0.3%)	450 (-1.4%)	444 (-2.7%)
	All	433	431 (-0.5%)	431 (-0.4%)	431 (-0.5%)	427 (-1.3%)
November	Wet	434	432 (-0.2%)	429 (-1%)	433 (-0.2%)	432 (-0.3%)
	Above Normal	439	438 (-0.3%)	431 (-1.8%)	439 (-0.2%)	427 (-2.9%)
	Below Normal	451	450 (-0.2%)	451 (-0.1%)	452 (0.2%)	452 (0%)
	Dry	440	442 (0.3%)	444 (0.8%)	442 (0.3%)	442 (0.4%)
	Critically Dry	444	445 (0.4%)	438 (-1.2%)	445 (0.3%)	437 (-1.5%)
	All	440	440 (0%)	438 (-0.6%)	441 (0%)	438 (-0.6%)
December	Wet	371	370 (-0.4%)	371 (0%)	370 (-0.4%)	366 (-1.4%)
	Above Normal	457	456 (-0.2%)	457 (-0.1%)	457 (-0.1%)	459 (0.5%)
	Below Normal	486	486 (0.1%)	486 (0%)	486 (0%)	486 (0.1%)
	Dry	485	483 (-0.2%)	477 (-1.5%)	483 (-0.2%)	470 (-3%)
	Critically Dry	500	502 (0.4%)	501 (0.1%)	500 (0%)	499 (-0.2%)
	All	447	447 (-0.1%)	446 (-0.4%)	446 (-0.2%)	442 (-1%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-34. Spring-run Juvenile Rearing WUA[a] in the Sacramento River, Segment 4, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
January	Wet	56	56 (0.4%)	56 (0.4%)	56 (0.4%)	56 (0.4%)
	Above Normal	64	64 (0.2%)	64 (0.2%)	64 (0.2%)	64 (0.2%)
	Below Normal	109	109 (-0.1%)	109 (0.4%)	109 (0%)	109 (0.4%)
	Dry	141	141 (0.2%)	141 (0.2%)	141 (0.2%)	141 (0.2%)
	Critically Dry	143	141 (-1.6%)	143 (0.1%)	142 (-0.2%)	144 (1%)
	All	98	97 (-0.2%)	98 (0.2%)	98 (0.1%)	98 (0.5%)
February	Wet	57	57 (0.2%)	57 (0.2%)	57 (0.2%)	57 (0.2%)
	Above Normal	59	59 (0.2%)	59 (-0.4%)	59 (0.3%)	58 (-1.5%)
	Below Normal	92	93 (0.4%)	92 (0%)	93 (0.5%)	91 (-1.2%)
	Dry	125	125 (0.4%)	125 (0.4%)	125 (0.4%)	125 (0.1%)
	Critically Dry	145	147 (0.9%)	147 (0.7%)	147 (0.8%)	147 (1%)
	All	91	92 (0.5%)	92 (0.3%)	92 (0.4%)	91 (0%)
March	Wet	62	62 (0%)	62 (0%)	62 (0%)	62 (0%)
	Above Normal	66	66 (0.1%)	66 (0.2%)	66 (0.1%)	66 (0.2%)
	Below Normal	124	124 (0%)	124 (0%)	124 (0%)	124 (0%)
	Dry	118	119 (0.3%)	119 (0.3%)	119 (0.3%)	118 (-0.4%)
	Critically Dry	137	136 (-1%)	137 (-0.3%)	136 (-0.9%)	137 (0%)
	All	97	96 (-0.1%)	97 (0%)	96 (-0.1%)	96 (-0.1%)
April	Wet	81	82 (0.6%)	82 (0.6%)	82 (0.6%)	82 (0.6%)
	Above Normal	105	105 (-0.2%)	104 (-1%)	105 (-0.2%)	104 (-1%)
	Below Normal	129	129 (0.3%)	129 (0.4%)	129 (0.3%)	129 (0%)
	Dry	135	137 (1.1%)	139 (2.6%)	137 (1.1%)	139 (2.8%)
	Critically Dry	149	150 (0.7%)	150 (0.9%)	150 (0.7%)	152 (1.9%)
	All	115	115 (0.6%)	116 (0.9%)	115 (0.6%)	116 (1.1%)
May	Wet	60	60 (0.2%)	60 (0.2%)	60 (0.2%)	60 (0.2%)
	Above Normal	70	72 (1.9%)	72 (2.1%)	72 (1.9%)	72 (2.1%)
	Below Normal	85	87 (2.8%)	93 (9.1%)^	87 (2.8%)	93 (9.4%)^
	Dry	86	90 (4%)	91 (5.9%)^	90 (4%)	94 (8.9%)^
	Critically Dry	87	98 (12.6%)^	99 (14%)^	98 (12.9%)^	99 (14.4%)^
	All	75	78 (4%)	80 (5.9%)^	78 (4%)	81 (6.8%)^
June	Wet	66	67 (1.2%)	67 (1.2%)	67 (1.2%)	67 (1.2%)
	Above Normal	58	59 (0.9%)	65 (11%)^	59 (0.9%)	67 (16%)^
	Below Normal	60	62 (2.2%)	64 (6%)^	61 (2.2%)	68 (13%)^
	Dry	56	58 (3.3%)	56 (0.7%)	58 (3.3%)	59 (5.6%)^

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	Critically Dry	71	71 (-0.3%)	71 (0.8%)	71 (0.2%)	71 (-0.5%)
	All	62	63 (1.5%)	64 (3.2%)	63 (1.6%)	66 (5.7%)^
July	Wet	47	46 (-3%)	46 (-3%)	46 (1.4%)	46 (-3%)
	Above Normal	47	47 (-0.3%)	48 (2.5%)	47 (1.4%)	51 (9.1%)^
	Below Normal	46	46 (-0.1%)	47 (1.5%)	46 (1.4%)	47 (1%)
	Dry	48	47 (-1.7%)	46 (-3.8%)	47 (1.4%)	48 (0.5%)
	Critically Dry	70	70 (-0.7%)	70 (-0.7%)	70 (1.4%)	69 (-1.2%)
	All	50	50 (-1.5%)	50 (-1.3%)	50 (1.4%)	51 (0.2%)
August	Wet	54	54 (-0.2%)	54 (-0.2%)	54 (1.4%)	54 (-0.2%)
	Above Normal	58	58 (0.5%)	58 (0.1%)	58 (1.4%)	68 (16.6%)^
	Below Normal	68	68 (0.4%)	68 (0.6%)	68 (1.4%)	69 (2.4%)
	Dry	76	74 (-2.9%)	74 (-3%)	74 (1.4%)	77 (0.5%)
	Critically Dry	89	91 (2.8%)	88 (-0.5%)	88 (1.4%)	88 (-0.5%)
	All	67	67 (-0.1%)	67 (-0.8%)	67 (1.4%)	69 (2.4%)
September	Wet	63	63 (-0.1%)	63 (-0.2%)	63 (1.4%)	63 (-0.1%)
	Above Normal	89	88 (-0.9%)	81 (-8.9%)*	88 (1.4%)	74 (-16.8%)*
	Below Normal	137	137 (-0.4%)	136 (-1.2%)	137 (1.4%)	133 (-2.9%)
	Dry	151	147 (-2.4%)	149 (-1.3%)	148 (1.4%)	150 (-0.8%)
	Critically Dry	155	153 (-1.6%)	152 (-1.9%)	153 (1.4%)	152 (-1.7%)
	All	113	111 (-1.3%)	110 (-2%)	111 (1.4%)	109 (-3%)
October	Wet	104	104 (-0.1%)	103 (-1.6%)	104 (1.4%)	101 (-3.3%)
	Above Normal	109	106 (-2.6%)	109 (-0.2%)	106 (1.4%)	109 (-0.5%)
	Below Normal	118	115 (-2.4%)	114 (-3.3%)	115 (1.4%)	112 (-4.6%)
	Dry	122	121 (-0.4%)	123 (0.7%)	122 (1.4%)	118 (-3.3%)
	Critically Dry	131	127 (-3.3%)	130 (-1.2%)	127 (1.4%)	125 (-5.1%)*
	All	115	113 (-1.4%)	114 (-1.1%)	113 (1.4%)	111 (-3.4%)
November	Wet	104	103 (-0.5%)	102 (-1.7%)	103 (1.4%)	104 (-0.1%)
	Above Normal	110	109 (-0.5%)	104 (-5.3%)*	109 (1.4%)	101 (-7.8%)*
	Below Normal	122	121 (-0.5%)	122 (0.1%)	123 (1.4%)	123 (0.7%)
	Dry	113	114 (0.8%)	116 (2.3%)	114 (1.4%)	115 (1.3%)
	Critically Dry	120	123 (2.6%)	119 (-1.3%)	123 (1.4%)	119 (-1.4%)
	All	112	113 (0.3%)	111 (-0.9%)	113 (1.4%)	111 (-1%)
December	Wet	65	64 (-1.3%)	65 (0.4%)	64 (1.4%)	64 (-1.5%)
	Above Normal	113	113 (-0.4%)	113 (-0.2%)	113 (1.4%)	115 (1.1%)
	Below Normal	136	136 (0.2%)	136 (0.2%)	136 (1.4%)	136 (0.3%)
	Dry	126	126 (0.1%)	124 (-1.6%)	126 (1.4%)	121 (-4.2%)
	Critically Dry	148	150 (1.6%)	148 (0.6%)	148 (1.4%)	148 (0.3%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	All	110	110 (0.1%)	109 (-0.2%)	110 (1.4%)	109 (-1.1%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Fall-run Chinook Salmon

Rearing habitat WUA for fall-run fry and juveniles was determined by USFWS (2005b) in the same manner that it was determined for winter-run. To estimate changes in rearing WUA that would result from Alternatives 1–3, the fall-run WUA curves developed for each of the three river segments was used with mean monthly CALSIM II flow estimates for corresponding river segments under Alternatives 1–3 and the NAA during the rearing periods for fry (December through March) and juveniles (February through June).

Differences in fall-run fry and juvenile rearing habitat WUA in each river segment under Alternatives 1–3 compared to the NAA were examined using the grand mean rearing WUA for each month of the fry and juvenile rearing periods under each water year type and all water year types combined (Table 11K-35 through Table 11K-40). In the tables of results, means that differed by >5% were highlighted in red for >5% reductions or green for >5% increases to flag the largest differences.

All the means for fry rearing WUA differ by less than 5% between Alternatives 1–3 and the NAA in all three river segments (Table 11K-35 through Table 11K-37). For juvenile rearing WUA, several of the means under Alternatives 1–3 are >5% larger than the means under the NAA (Table 11K-38 though Table 11K-40). This is particularly true for Alternatives 3 and 1B in Segment 4. All the >5% differences in means in all three segments consist of increases from the NAA to Alternatives 1–3. Some of the increases in Segment 4 are large, ranging up to 16% for June of Alternative 3. In May of critically dry years, the means under Alternatives 1–3 were 13% to 14% higher than the NAA means. The increases in all three segments occur in May and/or June. Note that the rearing WUA results for fall-run (Table 11K-35 through Table 11K-40) are identical to those for spring-run (Table 11K-29 through Table 11K-34) where the rearing periods overlap because both runs use the fall-run rearing WUA curves for the WUA computations.

The results for fall-run rearing WUA indicate only minor effects on fry rearing WUA and minor effects or moderate benefits on juvenile rearing habitat, especially under Alternatives 1B and 3 in Segment 4.

Table 11K-35. Fall-run Fry Rearing WUA[a] in the Sacramento River, Segment 6, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
September	Wet	75	75 (-0.4%)	75 (-0.4%)	75 (-0.4%)	75 (-0.6%)
	Above Normal	65	65 (0.1%)	65 (0%)	65 (0.2%)	65 (0.8%)
	Below Normal	70	69 (-0.3%)	69 (-0.4%)	69 (-0.4%)	70 (-0.1%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	Dry	65	65 (-0.3%)	64 (-1%)	65 (-0.4%)	65 (-0.8%)
	Critically Dry	68	67 (-1%)	67 (-0.6%)	67 (-0.7%)	67 (-1.6%)
	All	69	69 (-0.4%)	69 (-0.5%)	69 (-0.3%)	69 (-0.5%)
October	Wet	77	77 (0.1%)	77 (-0.1%)	77 (0.2%)	77 (-0.1%)
	Above Normal	69	69 (0%)	69 (0%)	69 (0%)	69 (0%)
	Below Normal	68	68 (0%)	68 (0.3%)	68 (0%)	68 (0.3%)
	Dry	71	72 (0.4%)	72 (0.4%)	72 (0.4%)	72 (0.4%)
	Critically Dry	70	70 (0.2%)	70 (0%)	70 (0.2%)	70 (-0.2%)
	All	72	72 (0.1%)	72 (0.1%)	72 (0.2%)	72 (0.1%)
November	Wet	79	79 (0%)	79 (0%)	79 (0%)	79 (0%)
	Above Normal	76	76 (-0.3%)	76 (-0.4%)	76 (-0.3%)	76 (0%)
	Below Normal	68	67 (-1.5%)	68 (-0.3%)	67 (-0.8%)	67 (-1.9%)
	Dry	71	71 (0.6%)	71 (0.7%)	71 (0.6%)	71 (0.2%)
	Critically Dry	70	70 (0.8%)	70 (0.8%)	70 (0.8%)	70 (0.9%)
	All	74	74 (-0.1%)	74 (0.1%)	74 (0%)	73 (-0.1%)
December	Wet	70	70 (0%)	70 (0%)	70 (0%)	70 (0%)
	Above Normal	69	69 (-0.1%)	69 (-0.1%)	69 (-0.1%)	69 (-0.1%)
	Below Normal	70	70 (0%)	70 (0%)	70 (0%)	70 (0%)
	Dry	69	70 (1%)	70 (0.7%)	70 (1%)	69 (-0.4%)
	Critically Dry	68	68 (0.1%)	68 (0%)	68 (0.1%)	68 (0.2%)
	All	69	70 (0.2%)	70 (0.2%)	70 (0.2%)	69 (-0.1%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-36. Fall-run Fry Rearing WUA[a] in the Sacramento River, Segment 5, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
September	Wet	1086	1083 (-0.2%)	1089 (0.3%)	1083 (-0.2%)	1071 (-1.3%)
	Above Normal	1297	1297 (0%)	1298 (0.1%)	1298 (0.1%)	1315 (1.4%)
	Below Normal	1391	1392 (0.1%)	1390 (0%)	1391 (0.1%)	1393 (0.2%)
	Dry	1319	1315 (-0.3%)	1292 (-2%)	1315 (-0.3%)	1259 (-4.5%)
	Critically Dry	1409	1415 (0.4%)	1406 (-0.2%)	1403 (-0.4%)	1397 (-0.8%)
	All	1267	1267 (0%)	1262 (-0.4%)	1265 (-0.2%)	1251 (-1.3%)
October	Wet	1080	1082 (0.1%)	1082 (0.2%)	1082 (0.1%)	1082 (0.2%)
	Above Normal	1203	1203 (0%)	1203 (0%)	1203 (0%)	1203 (0%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	Below Normal	1351	1351 (0%)	1357 (0.4%)	1352 (0%)	1356 (0.3%)
	Dry	1444	1444 (0%)	1444 (0%)	1444 (0%)	1444 (0%)
	Critically Dry	1412	1402 (-0.7%)	1413 (0.1%)	1411 (-0.1%)	1421 (0.7%)
	All	1273	1272 (-0.1%)	1275 (0.1%)	1273 (0%)	1276 (0.2%)
November	Wet	1097	1096 (-0.1%)	1096 (-0.1%)	1096 (-0.1%)	1096 (-0.1%)
	Above Normal	1150	1150 (-0.1%)	1150 (0%)	1150 (0%)	1157 (0.6%)
	Below Normal	1236	1237 (0.1%)	1224 (-1%)	1243 (0.6%)	1210 (-2.1%)
	Dry	1444	1445 (0.1%)	1446 (0.1%)	1445 (0.1%)	1444 (0%)
	Critically Dry	1452	1458 (0.4%)	1454 (0.2%)	1455 (0.3%)	1458 (0.5%)
	All	1256	1258 (0.1%)	1255 (-0.1%)	1258 (0.1%)	1254 (-0.2%)
December	Wet	1094	1094 (0%)	1094 (0%)	1094 (0%)	1094 (0%)
	Above Normal	1087	1087 (0%)	1088 (0.1%)	1087 (0%)	1088 (0.1%)
	Below Normal	1398	1398 (0%)	1398 (0%)	1398 (0%)	1398 (0%)
	Dry	1362	1369 (0.5%)	1365 (0.2%)	1369 (0.5%)	1355 (-0.5%)
	Critically Dry	1372	1364 (-0.6%)	1368 (-0.3%)	1365 (-0.6%)	1364 (-0.6%)
	All	1245	1245 (0%)	1245 (0%)	1245 (0%)	1242 (-0.2%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-37. Fall-run Fry Rearing WUA[a] in the Sacramento River, Segment 4, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
September	Wet	159	158 (-0.1%)	159 (0.2%)	158 (-0.1%)	158 (-0.4%)
	Above Normal	183	183 (-0.4%)	183 (-0.3%)	183 (-0.3%)	184 (0%)
	Below Normal	203	203 (-0.3%)	202 (-0.5%)	202 (-0.3%)	203 (0%)
	Dry	197	196 (-0.5%)	195 (-0.9%)	196 (-0.5%)	195 (-1%)
	Critically Dry	217	216 (-0.3%)	216 (-0.5%)	215 (-0.7%)	213 (-1.6%)
	All	187	186 (-0.3%)	186 (-0.4%)	186 (-0.4%)	186 (-0.6%)
October	Wet	154	155 (0.1%)	155 (0.2%)	155 (0.1%)	155 (0.2%)
	Above Normal	161	161 (0%)	161 (0%)	161 (0%)	161 (0%)
	Below Normal	189	189 (0%)	189 (0.2%)	189 (0%)	189 (0.1%)
	Dry	207	208 (0.1%)	208 (0.1%)	208 (0.1%)	208 (0.2%)
	Critically Dry	213	212 (-0.2%)	213 (0%)	212 (-0.1%)	213 (0.2%)
	All	181	181 (0%)	182 (0.1%)	181 (0.1%)	182 (0.1%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
November	Wet	156	156 (0%)	156 (0%)	156 (0%)	156 (0%)
	Above Normal	155	155 (0.2%)	155 (0.3%)	155 (0.3%)	152 (-1.5%)
	Below Normal	175	175 (0.2%)	175 (0%)	175 (0%)	174 (-0.3%)
	Dry	197	198 (0.5%)	198 (0.8%)	198 (0.5%)	198 (0.3%)
	Critically Dry	212	212 (0.3%)	212 (0.2%)	212 (0.2%)	212 (0.3%)
	All	176	177 (0.2%)	177 (0.3%)	177 (0.2%)	176 (-0.1%)
December	Wet	159	159 (0%)	159 (0%)	159 (0%)	159 (0%)
	Above Normal	160	160 (0.1%)	160 (0.1%)	160 (0.1%)	160 (0.1%)
	Below Normal	193	193 (0%)	193 (0%)	193 (0%)	193 (0%)
	Dry	193	194 (0.3%)	193 (0%)	194 (0.3%)	192 (-0.3%)
	Critically Dry	199	200 (0.1%)	199 (-0.1%)	200 (0.2%)	199 (-0.1%)
	All	178	178 (0.1%)	178 (0%)	178 (0.1%)	178 (-0.1%)

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^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-38. Fall-run Juvenile Rearing WUA[a] in the Sacramento River, Segment 6, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
February	Wet	29	29 (-0.1%)	29 (-0.1%)	29 (-0.1%)	29 (-0.1%)
	Above Normal	29	28 (-0.9%)	28 (-1.7%)	28 (-1%)	28 (-3.1%)
	Below Normal	29	28 (-0.8%)	29 (-0.2%)	29 (-0.2%)	28 (-1.5%)
	Dry	33	34 (0.6%)	34 (0.3%)	34 (0.6%)	33 (-0.1%)
	Critically Dry	33	33 (0.8%)	33 (0.8%)	33 (0.8%)	33 (0.8%)
	All	31	31 (0%)	30 (-0.1%)	31 (0.1%)	30 (-0.6%)
March	Wet	26	26 (0%)	26 (0%)	26 (0%)	26 (0%)
	Above Normal	26	26 (-0.2%)	26 (-0.5%)	26 (-0.2%)	26 (-0.5%)
	Below Normal	32	32 (0%)	32 (0%)	32 (0%)	32 (0%)
	Dry	33	33 (0.8%)	33 (0.8%)	33 (0.8%)	32 (-0.3%)
	Critically Dry	33	32 (-0.2%)	33 (-0.1%)	32 (-0.2%)	32 (-0.2%)
	All	29	29 (0.1%)	29 (0.1%)	29 (0.1%)	29 (-0.2%)
April	Wet	39	38 (-1.5%)	38 (-1.5%)	38 (-1.5%)	38 (-1.5%)
	Above Normal	43	42 (-1.5%)	42 (-2.8%)	42 (-1.5%)	42 (-2.8%)
	Below Normal	44	44 (0%)	44 (0.3%)	44 (0%)	45 (1.8%)
	Dry	43	43 (0.4%)	44 (0.7%)	43 (0.4%)	44 (0.7%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	Critically Dry	43	44 (0.9%)	45 (3%)	44 (1%)	43 (0.6%)
	All	42	42 (-0.4%)	42 (-0.2%)	42 (-0.4%)	42 (-0.3%)
May	Wet	37	37 (0%)	37 (0%)	37 (0%)	37 (0%)
	Above Normal	39	39 (-0.3%)	39 (-0.3%)	39 (-0.3%)	39 (-0.3%)
	Below Normal	42	42 (0.3%)	42 (1%)	42 (0.3%)	42 (0.3%)
	Dry	41	42 (0.9%)	42 (0.9%)	42 (0.9%)	42 (1.7%)
	Critically Dry	42	42 (2%)	43 (2.3%)	42 (2%)	43 (3.7%)
	All	40	40 (0.5%)	40 (0.7%)	40 (0.5%)	40 (1%)
June	Wet	40	40 (0.1%)	40 (0.1%)	40 (0.1%)	40 (0.1%)
	Above Normal	37	37 (0.2%)	39 (5.2%)^	37 (0.2%)	39 (7%)^
	Below Normal	36	36 (0.4%)	37 (1.6%)	36 (0.4%)	38 (5.2%)^
	Dry	34	35 (2.2%)	35 (2.1%)	35 (2.2%)	35 (3%)
	Critically Dry	38	38 (-0.2%)	39 (0.7%)	38 (-0.1%)	39 (0.6%)
	All	37	38 (0.5%)	38 (1.6%)	38 (0.5%)	38 (2.6%)

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^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-39. Fall-run Juvenile Rearing WUA[a] in the Sacramento River, Segment 5, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
February	Wet	364	363 (-0.1%)	363 (-0.1%)	363 (-0.1%)	363 (-0.1%)
	Above Normal	383	381 (-0.6%)	379 (-1.2%)	381 (-0.7%)	375 (-2.1%)
	Below Normal	441	440 (-0.1%)	438 (-0.6%)	443 (0.4%)	433 (-1.8%)
	Dry	508	510 (0.3%)	508 (0.1%)	510 (0.3%)	508 (-0.1%)
	Critically Dry	512	513 (0.2%)	513 (0.1%)	513 (0.2%)	514 (0.3%)
	All	433	433 (0%)	432 (-0.3%)	433 (0.1%)	431 (-0.6%)
March	Wet	366	366 (0%)	366 (0%)	366 (0%)	366 (0%)
	Above Normal	388	387 (-0.1%)	386 (-0.4%)	387 (-0.1%)	386 (-0.4%)
	Below Normal	489	489 (0%)	489 (0%)	489 (0%)	489 (0%)
	Dry	493	495 (0.3%)	494 (0.1%)	495 (0.3%)	492 (-0.4%)
	Critically Dry	495	494 (-0.3%)	495 (0%)	494 (-0.3%)	496 (0.2%)
	All	437	437 (0%)	437 (0%)	437 (0%)	436 (-0.1%)
April	Wet	419	420 (0.2%)	420 (0.2%)	420 (0.2%)	420 (0.2%)
	Above Normal	463	463 (-0.1%)	461 (-0.4%)	463 (-0.1%)	461 (-0.4%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	Below Normal	498	499 (0.2%)	498 (0.1%)	499 (0.2%)	496 (-0.3%)
	Dry	492	493 (0.3%)	496 (0.8%)	493 (0.3%)	496 (0.9%)
	Critically Dry	498	497 (-0.3%)	497 (-0.2%)	497 (-0.3%)	501 (0.5%)
	All	467	467 (0.1%)	467 (0.2%)	467 (0.1%)	468 (0.2%)
May	Wet	362	362 (-0.1%)	362 (-0.1%)	362 (-0.1%)	362 (-0.1%)
	Above Normal	379	380 (0.5%)	381 (0.5%)	380 (0.5%)	381 (0.5%)
	Below Normal	406	410 (0.9%)	417 (2.7%)	410 (0.9%)	417 (2.6%)
	Dry	399	404 (1.3%)	407 (2%)	404 (1.3%)	411 (3%)
	Critically Dry	399	416 (4.5%)	418 (4.8%)	417 (4.5%)	419 (5%)^
	All	386	390 (1.2%)	392 (1.7%)	390 (1.2%)	393 (2%)
June	Wet	374	375 (0.4%)	375 (0.4%)	375 (0.4%)	375 (0.4%)
	Above Normal	347	348 (0.3%)	362 (4.4%)	348 (0.3%)	368 (6.2%)^
	Below Normal	347	349 (0.6%)	353 (1.8%)	349 (0.6%)	364 (5.1%)^
	Dry	336	340 (1.3%)	339 (0.8%)	340 (1.3%)	342 (1.9%)
	Critically Dry	363	362 (-0.1%)	364 (0.4%)	362 (0%)	363 (0.2%)
	All	355	357 (0.5%)	360 (1.3%)	357 (0.5%)	363 (2.3%)

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^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-40. Fall-run Juvenile Rearing WUA[a] in the Sacramento River, Segment 4, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
February	Wet	57	57 (0.2%)	57 (0.2%)	57 (0.2%)	57 (0.2%)
	Above Normal	59	59 (0.2%)	59 (-0.4%)	59 (0.3%)	58 (-1.5%)
	Below Normal	92	93 (0.4%)	92 (0%)	93 (0.5%)	91 (-1.2%)
	Dry	125	125 (0.4%)	125 (0.4%)	125 (0.4%)	125 (0.1%)
	Critically Dry	145	147 (0.9%)	147 (0.7%)	147 (0.8%)	147 (1%)
	All	91	92 (0.5%)	92 (0.3%)	92 (0.4%)	91 (0%)
March	Wet	62	62 (0%)	62 (0%)	62 (0%)	62 (0%)
	Above Normal	66	66 (0.1%)	66 (0.2%)	66 (0.1%)	66 (0.2%)
	Below Normal	124	124 (0%)	124 (0%)	124 (0%)	124 (0%)
	Dry	118	119 (0.3%)	119 (0.3%)	119 (0.3%)	118 (-0.4%)
	Critically Dry	137	136 (-1%)	137 (-0.3%)	136 (-0.9%)	137 (0%)
	All	97	96 (-0.1%)	97 (0%)	96 (-0.1%)	96 (-0.1%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
April	Wet	81	82 (0.6%)	82 (0.6%)	82 (0.6%)	82 (0.6%)
	Above Normal	105	105 (-0.2%)	104 (-1%)	105 (-0.2%)	104 (-1%)
	Below Normal	129	129 (0.3%)	129 (0.4%)	129 (0.3%)	129 (0%)
	Dry	135	137 (1.1%)	139 (2.6%)	137 (1.1%)	139 (2.8%)
	Critically Dry	149	150 (0.7%)	150 (0.9%)	150 (0.7%)	152 (1.9%)
	All	115	115 (0.6%)	116 (0.9%)	115 (0.6%)	116 (1.1%)
May	Wet	60	60 (0.2%)	60 (0.2%)	60 (0.2%)	60 (0.2%)
	Above Normal	70	72 (1.9%)	72 (2.1%)	72 (1.9%)	72 (2.1%)
	Below Normal	85	87 (2.8%)	93 (9.1%)^	87 (2.8%)	93 (9.4%)^
	Dry	86	90 (4%)	91 (5.9%)^	90 (4%)	94 (8.9%)^
	Critically Dry	87	98 (12.6%)^	99 (14%)^	98 (12.9%)	99 (14.4%)^
	All	75	78 (4%)	80 (5.9%)^	78 (4%)	81 (6.8%)
June	Wet	66	67 (1.2%)	67 (1.2%)	67 (1.2%)	67 (1.2%)
	Above Normal	58	59 (0.9%)	65 (11%)^	59 (0.9%)	67 (16%)^
	Below Normal	60	62 (2.2%)	64 (6%)^	61 (2.2%)	68 (13%)^
	Dry	56	58 (3.3%)	56 (0.7%)	58 (3.3%)	59 (5.6%)^
	Critically Dry	71	71 (-0.3%)	71 (0.8%)	71 (0.2%)	71 (-0.5%)
	All	62	63 (1.5%)	64 (3.2%)	63 (1.6%)	66 (5.7%)

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Late Fall–run Chinook Salmon

Rearing habitat WUA for late fall–run Chinook salmon fry and juveniles was determined by USFWS (2005a) in the same manner that it was determined for winter-run and fall-run Chinook salmon. To estimate changes in rearing WUA that would result from Alternatives 1–3, the late fall–run Chinook salmon WUA curves developed for each of the three river segments was used with mean monthly CALSIM II flow estimates for corresponding river segments under Alternatives 1–3 and the NAA during the rearing periods for late fall–run fry (March through June) and juveniles (May through October).

Differences in late fall–run fry and juvenile rearing habitat WUA in each river segment under Alternatives 1–3 compared to the NAA were examined using the grand mean rearing WUA for each month of the fry and juvenile rearing periods under each water year type and all water year types combined (Table 11K-41 through Table 11K-46). In the tables of results, means that differed by >5% were highlighted in red for >5% reductions or green for >5% increases to flag the largest differences. All differences between Alternatives 1–3 and NAA means for late fall–run fry rearing WUA that are >5% result from increases in rearing WUA. Segment 6 has seven >5% increases in the means (Table 11K-41), Segment 5 has four (Table 11K-42), and Segment 4 has one (Table 11K-43). In Segments 6 and 5, means increased >5% under Alternatives 1–3 in

May of critically dry years. These results indicate that Alternatives 1–3 would have only minor effects or moderate benefits to late fall–run fry rearing habitat, depending on month and water year type.

Late fall–run juvenile rearing WUA is similar or up to 7% higher under Alternatives 1–3 than under the NAA in Segments 6 and 5 (Table 11K-44 and Table 11K-45), with all increases occurring under Alternative 3. There are many more substantial differences in juvenile rearing WUA between Alternatives 1–3 and the NAA in Segment 4 (Table 11K-46). All but two of the 18 means that differ from the NAA mean by more than 5% are increases, but one of the two reductions in WUA (September of above normal years under Alternative 3) is especially large (about 16%). Seven of the increases in rearing WUA are greater than 10%. The 16 large (>5%) increases in juvenile rearing WUA occur in the spring and summer months, especially in May and June (Table 11K-46). The results for juvenile rearing WUA indicate largely minor differences between Alternatives 1–3 and the NAA for Segments 6 and 5, but substantial differences for Segment 4. The segment would generally result in increased juvenile rearing habitat under Alternatives 1B and 3 during spring and summer, but some reduction in habitat during September of above normal years. Alternative 3 would result in the greatest differences.

Table 11K-41. Late Fall–run Fry Rearing WUA[a] in the Sacramento River, Segment 6, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
March	Wet	65	65 (0%)	65 (0%)	65 (0%)	65 (0%)
	Above Normal	64	64 (-0.2%)	64 (-0.2%)	64 (-0.2%)	64 (-0.3%)
	Below Normal	62	62 (0%)	62 (0%)	62 (0%)	62 (0%)
	Dry	61	62 (0.8%)	61 (-0.3%)	62 (0.9%)	61 (-0.8%)
	Critically Dry	61	61 (-0.2%)	61 (0.1%)	61 (-0.2%)	61 (0.5%)
	All	63	63 (0.1%)	63 (-0.1%)	63 (0.1%)	63 (-0.1%)
April	Wet	93	93 (0%)	93 (0%)	93 (0%)	93 (0%)
	Above Normal	107	107 (0.1%)	106 (-0.5%)	107 (0.1%)	106 (-0.5%)
	Below Normal	117	117 (0.3%)	117 (0.3%)	117 (0.3%)	117 (0.2%)
	Dry	114	116 (1.1%)	115 (0.8%)	116 (1.1%)	116 (0.9%)
	Critically Dry	118	118 (0.5%)	118 (0.1%)	118 (0.5%)	118 (0%)
	All	107	108 (0.4%)	108 (0.2%)	108 (0.4%)	108 (0.2%)
May	Wet	73	73 (-0.1%)	73 (-0.1%)	73 (-0.1%)	73 (-0.1%)
	Above Normal	76	78 (1.8%)	78 (2%)	78 (1.8%)	78 (2%)
	Below Normal	84	85 (1.1%)	88 (4.8%)	85 (1.1%)	87 (3.3%)
	Dry	80	82 (2.4%)	84 (4.7%)	82 (2.5%)	86 (7.7%)^
	Critically Dry	81	86 (6.8%)^	87 (7.5%)^	86 (6.5%)^	89 (10.1%)^
	All	78	80 (2%)	81 (3.4%)	79 (2%)	81 (4.1%)
June	Wet	72	73 (0.6%)	73 (0.6%)	73 (0.6%)	73 (0.6%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	Above Normal	62	63 (0.8%)	66 (5.4%)^	63 (0.8%)	68 (8.4%)^
	Below Normal	69	70 (0.8%)	71 (2%)	70 (0.8%)	71 (2.5%)
	Dry	68	68 (-0.2%)	69 (0.4%)	68 (-0.2%)	68 (-0.5%)
	Critically Dry	68	68 (-0.1%)	68 (0.2%)	68 (0.2%)	68 (0.2%)
	All	69	69 (0.4%)	70 (1.4%)	69 (0.4%)	70 (1.6%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-42. Late Fall–run Fry Rearing WUA[a] in the Sacramento River, Segment 5, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
March	Wet	1047	1047 (0%)	1047 (0%)	1047 (0%)	1047 (0%)
	Above Normal	1029	1030 (0%)	1032 (0.2%)	1030 (0%)	1031 (0.2%)
	Below Normal	1352	1352 (0%)	1352 (0%)	1352 (0%)	1352 (0%)
	Dry	1311	1316 (0.4%)	1311 (0.1%)	1315 (0.3%)	1305 (-0.5%)
	Critically Dry	1324	1315 (-0.6%)	1319 (-0.3%)	1316 (-0.6%)	1315 (-0.6%)
	All	1195	1195 (0%)	1195 (0%)	1195 (0%)	1193 (-0.2%)
April	Wet	1125	1129 (0.3%)	1129 (0.3%)	1129 (0.3%)	1129 (0.3%)
	Above Normal	1209	1207 (-0.2%)	1196 (-1%)	1207 (-0.2%)	1196 (-1%)
	Below Normal	1332	1339 (0.5%)	1335 (0.2%)	1339 (0.5%)	1323 (-0.7%)
	Dry	1294	1297 (0.2%)	1310 (1.2%)	1297 (0.2%)	1312 (1.3%)
	Critically Dry	1343	1335 (-0.6%)	1337 (-0.5%)	1335 (-0.6%)	1347 (0.3%)
	All	1242	1243 (0.1%)	1244 (0.2%)	1243 (0.1%)	1244 (0.2%)
May	Wet	879	879 (0.1%)	879 (0.1%)	879 (0.1%)	880 (0.1%)
	Above Normal	886	896 (1.1%)	897 (1.2%)	896 (1.1%)	897 (1.2%)
	Below Normal	925	936 (1.2%)	965 (4.3%)	935 (1.1%)	959 (3.7%)
	Dry	919	939 (2.2%)	948 (3.1%)	939 (2.2%)	959 (4.3%)
	Critically Dry	883	938 (6.2%)^	944 (6.9%)^	940 (6.5%)^	954 (8%)^
	All	897	913 (1.8%)	921 (2.7%)	913 (1.8%)	924 (3%)
June	Wet	821	826 (0.6%)	826 (0.6%)	826 (0.6%)	826 (0.6%)
	Above Normal	801	804 (0.4%)	807 (0.8%)	804 (0.4%)	812 (1.4%)
	Below Normal	836	841 (0.6%)	844 (0.9%)	841 (0.6%)	839 (0.3%)
	Dry	846	842 (-0.5%)	846 (0%)	842 (-0.5%)	839 (-0.9%)
	Critically Dry	816	817 (0.1%)	816 (0%)	817 (0.2%)	812 (-0.5%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	All	826	828 (0.3%)	829 (0.4%)	828 (0.3%)	827 (0.2%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-43. Late Fall–run Fry Rearing WUA[a] in the Sacramento River, Segment 4, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
March	Wet	148	148 (0%)	148 (0%)	148 (0%)	148 (0%)
	Above Normal	143	143 (0%)	143 (0%)	143 (0%)	143 (0%)
	Below Normal	176	176 (0%)	176 (0%)	176 (0%)	176 (0%)
	Dry	174	175 (0.3%)	174 (0.1%)	175 (0.3%)	174 (-0.3%)
	Critically Dry	183	183 (-0.1%)	183 (-0.1%)	183 (-0.1%)	183 (-0.1%)
	All	163	163 (0.1%)	163 (0%)	163 (0%)	163 (-0.1%)
April	Wet	153	153 (0.1%)	153 (0.1%)	153 (0.1%)	153 (0.1%)
	Above Normal	167	167 (0%)	166 (-0.2%)	167 (0%)	166 (-0.2%)
	Below Normal	180	180 (0.1%)	181 (0.3%)	180 (0.1%)	180 (0%)
	Dry	185	185 (0.3%)	186 (0.7%)	185 (0.3%)	186 (0.8%)
	Critically Dry	194	193 (-0.4%)	193 (-0.4%)	193 (-0.4%)	196 (0.8%)
	All	173	173 (0%)	173 (0.2%)	173 (0%)	173 (0.3%)
May	Wet	143	143 (0.1%)	143 (0.1%)	143 (0.1%)	143 (0.1%)
	Above Normal	151	151 (0.3%)	151 (0.4%)	151 (0.3%)	151 (0.4%)
	Below Normal	161	162 (0.6%)	164 (1.9%)	162 (0.6%)	164 (1.8%)
	Dry	161	162 (1%)	163 (1.5%)	162 (1%)	164 (2.2%)
	Critically Dry	162	168 (3.3%)	168 (3.6%)	168 (3.3%)	168 (3.8%)
	All	154	155 (0.9%)	156 (1.3%)	155 (0.9%)	156 (1.5%)
June	Wet	151	152 (0.3%)	152 (0.3%)	152 (0.3%)	152 (0.3%)
	Above Normal	144	145 (0.3%)	150 (3.9%)	145 (0.3%)	152 (5.2%)^
	Below Normal	145	146 (0.4%)	147 (1.4%)	146 (0.4%)	151 (3.9%)
	Dry	142	144 (1.4%)	144 (1.3%)	144 (1.4%)	145 (1.9%)
	Critically Dry	153	153 (-0.1%)	154 (0.4%)	153 (-0.1%)	153 (0.2%)
	All	147	148 (0.5%)	149 (1.2%)	148 (0.5%)	150 (1.9%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-44. Late Fall–run Juvenile Rearing WUA[a] in the Sacramento River, Segment 6, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
May	Wet	38	38 (0%)	38 (0%)	38 (0%)	38 (0%)
	Above Normal	39	39 (-0.3%)	39 (-0.4%)	39 (-0.3%)	39 (-0.4%)
	Below Normal	41	41 (0%)	41 (0.1%)	41 (0%)	41 (0.6%)
	Dry	41	41 (0.3%)	41 (0.5%)	41 (0.3%)	42 (1%)
	Critically Dry	42	42 (1.4%)	43 (1.7%)	42 (1.4%)	42 (0.7%)
	All	40	40 (0.2%)	40 (0.3%)	40 (0.2%)	40 (0.4%)
June	Wet	41	41 (-0.1%)	41 (-0.1%)	41 (-0.1%)	41 (-0.1%)
	Above Normal	38	38 (0.1%)	39 (4.5%)	38 (0.2%)	40 (5.8%)^
	Below Normal	37	37 (0.2%)	37 (1.2%)	37 (0.2%)	38 (4.1%)
	Dry	35	36 (2.1%)	36 (2%)	36 (2.1%)	36 (2.9%)
	Critically Dry	39	39 (-0.2%)	39 (0.6%)	39 (-0.1%)	39 (0.5%)
	All	38	38 (0.4%)	39 (1.3%)	38 (0.4%)	39 (2.2%)
July	Wet	32	32 (-0.6%)	32 (-0.6%)	32 (-0.6%)	32 (-0.6%)
	Above Normal	32	32 (0.3%)	33 (3.6%)	32 (0.4%)	33 (5.6%)^
	Below Normal	32	32 (-0.5%)	32 (0.5%)	32 (-0.5%)	33 (1.3%)
	Dry	32	32 (-1%)	32 (-1.7%)	32 (-1%)	32 (0%)
	Critically Dry	38	38 (-0.4%)	38 (-0.3%)	38 (-0.3%)	38 (0.3%)
	All	33	33 (-0.5%)	33 (-0.1%)	33 (-0.5%)	33 (0.8%)
August	Wet	35	35 (-0.1%)	35 (-0.1%)	35 (-0.1%)	35 (-0.1%)
	Above Normal	35	35 (0.4%)	35 (-0.3%)	35 (0.4%)	38 (6.7%)^
	Below Normal	38	38 (0.2%)	38 (0.2%)	38 (0.1%)	39 (0.6%)
	Dry	40	39 (-1.7%)	40 (-1.1%)	39 (-1.8%)	40 (0.7%)
	Critically Dry	41	41 (0.3%)	41 (0.1%)	41 (0%)	41 (0%)
	All	38	37 (-0.3%)	37 (-0.3%)	37 (-0.4%)	38 (1.1%)
September	Wet	37	37 (-0.1%)	36 (-0.2%)	37 (-0.1%)	37 (-0.1%)
	Above Normal	41	41 (0.3%)	41 (-0.2%)	41 (0.3%)	41 (-1.5%)
	Below Normal	42	42 (-0.2%)	42 (0.2%)	42 (-0.3%)	42 (-0.2%)
	Dry	41	41 (0.1%)	41 (0.5%)	41 (0.1%)	41 (0.3%)
	Critically Dry	41	41 (0%)	41 (0.2%)	41 (0%)	41 (0.4%)
	All	40	40 (0%)	40 (0.1%)	40 (0%)	40 (-0.1%)
October	Wet	42	42 (0%)	42 (0.1%)	42 (0%)	42 (-0.3%)
	Above Normal	42	42 (0%)	42 (0%)	42 (-0.1%)	42 (-0.7%)
	Below Normal	42	42 (0.3%)	42 (0.5%)	42 (0.4%)	42 (0.9%)
	Dry	42	42 (-0.7%)	42 (-0.4%)	42 (-0.7%)	42 (0.4%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	Critically Dry	41	42 (1.4%)	41 (0.8%)	42 (1.3%)	42 (1.8%)
	All	42	42 (0.1%)	42 (0.1%)	42 (0.1%)	42 (0.3%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-45. Late Fall–run Juvenile Rearing WUA[a] in the Sacramento River, Segment 5, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
May	Wet	334	334 (-0.1%)	334 (-0.1%)	334 (-0.1%)	334 (-0.1%)
	Above Normal	348	349 (0.4%)	349 (0.5%)	349 (0.4%)	349 (0.5%)
	Below Normal	371	374 (0.9%)	380 (2.5%)	374 (0.8%)	380 (2.4%)
	Dry	365	370 (1.3%)	372 (1.9%)	370 (1.3%)	375 (2.9%)
	Critically Dry	365	380 (4.3%)	382 (4.6%)	381 (4.3%)	382 (4.8%)
	All	354	358 (1.1%)	359 (1.6%)	358 (1.1%)	360 (1.8%)
June	Wet	344	345 (0.3%)	345 (0.3%)	345 (0.3%)	345 (0.3%)
	Above Normal	320	321 (0.3%)	333 (4.2%)	321 (0.3%)	338 (5.8%)^
	Below Normal	320	322 (0.6%)	326 (1.7%)	322 (0.6%)	335 (4.7%)
	Dry	311	314 (1.2%)	313 (0.8%)	314 (1.2%)	316 (1.8%)
	Critically Dry	334	333 (-0.1%)	335 (0.4%)	334 (0%)	334 (0.1%)
	All	327	329 (0.5%)	331 (1.2%)	329 (0.5%)	334 (2.1%)
July	Wet	289	289 (-0.3%)	289 (-0.3%)	289 (-0.3%)	289 (-0.3%)
	Above Normal	282	282 (0.1%)	288 (2.1%)	282 (0.1%)	292 (3.5%)
	Below Normal	287	286 (-0.4%)	288 (0.2%)	286 (-0.3%)	289 (0.5%)
	Dry	293	292 (-0.4%)	291 (-0.8%)	292 (-0.4%)	294 (0.3%)
	Critically Dry	328	327 (-0.2%)	328 (-0.1%)	328 (-0.1%)	327 (-0.2%)
	All	294	294 (-0.2%)	295 (0%)	294 (-0.2%)	296 (0.5%)
August	Wet	305	305 (0%)	305 (0%)	305 (0%)	305 (0%)
	Above Normal	308	308 (0.3%)	307 (-0.1%)	308 (0.3%)	323 (5.1%)^
	Below Normal	325	326 (0.2%)	326 (0.2%)	326 (0.1%)	328 (0.8%)
	Dry	339	334 (-1.3%)	335 (-1.1%)	334 (-1.3%)	340 (0.3%)
	Critically Dry	355	358 (0.8%)	354 (-0.2%)	354 (-0.2%)	355 (0%)
	All	324	323 (-0.1%)	323 (-0.3%)	323 (-0.3%)	327 (0.9%)
September	Wet	318	318 (0%)	318 (-0.1%)	318 (0%)	318 (0%)
	Above Normal	357	356 (-0.2%)	349 (-2.3%)	356 (-0.3%)	340 (-4.8%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	Below Normal	410	410 (0%)	408 (-0.6%)	410 (0%)	406 (-1.1%)
	Dry	435	431 (-1%)	431 (-1%)	431 (-0.9%)	433 (-0.5%)
	Critically Dry	445	441 (-1%)	440 (-1.2%)	441 (-1%)	441 (-0.9%)
	All	384	382 (-0.5%)	381 (-0.9%)	382 (-0.4%)	380 (-1.1%)
October	Wet	384	383 (-0.2%)	381 (-0.9%)	383 (-0.2%)	380 (-1%)
	Above Normal	386	385 (-0.4%)	387 (0.1%)	384 (-0.5%)	384 (-0.5%)
	Below Normal	395	392 (-0.7%)	391 (-1%)	392 (-0.8%)	390 (-1.3%)
	Dry	399	400 (0%)	401 (0.3%)	400 (0.1%)	396 (-0.9%)
	Critically Dry	415	409 (-1.4%)	413 (-0.3%)	409 (-1.3%)	404 (-2.6%)
	All	394	392 (-0.4%)	392 (-0.4%)	392 (-0.4%)	389 (-1.2%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-46. Late Fall–run Juvenile Rearing WUA[a] in the Sacramento River, Segment 4, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
May	Wet	60	60 (0.6%)	60 (0.6%)	60 (0.6%)	60 (0.7%)
	Above Normal	68	69 (1.7%)	69 (1.9%)	69 (1.7%)	69 (1.9%)
	Below Normal	80	82 (2.6%)	86 (8.5%)^	82 (2.6%)	86 (8.7%)^
	Dry	81	84 (3.7%)	85 (5.5%)^	84 (3.7%)	88 (8.3%)^
	Critically Dry	81	91 (11.7%)^	92 (13%)^	91 (11.9%)^	92 (13.3%)^
	All	72	75 (3.7%)	76 (5.5%)^	75 (3.8%)	77 (6.3%)^
June	Wet	64	64 (1.1%)	64 (1.1%)	64 (1.1%)	64 (1.1%)
	Above Normal	57	58 (0.8%)	62 (9.2%)^	58 (0.8%)	65 (13.6%)^
	Below Normal	59	60 (2%)	62 (4.6%)	60 (2%)	67 (12.7%)^
	Dry	58	59 (2.7%)	59 (1.9%)	59 (2.6%)	60 (4.4%)
	Critically Dry	68	67 (-0.3%)	68 (0.7%)	68 (0.1%)	67 (-0.4%)
	All	61	62 (1.3%)	63 (2.9%)	62 (1.4%)	64 (5.2%)^
July	Wet	50	50 (-0.3%)	50 (-0.3%)	50 (-0.3%)	50 (-0.3%)
	Above Normal	47	47 (0.2%)	49 (4.2%)	47 (0.2%)	50 (7.3%)^
	Below Normal	49	49 (-0.8%)	49 (0.1%)	49 (-0.7%)	50 (0.9%)
	Dry	53	52 (-1.1%)	52 (-1.7%)	52 (-1.1%)	53 (0.5%)
	Critically Dry	67	67 (-0.3%)	67 (-0.1%)	67 (-0.2%)	67 (-0.9%)
	All	53	52 (-0.5%)	53 (0%)	52 (-0.5%)	53 (0.9%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
August	Wet	56	57 (0%)	57 (0%)	57 (0%)	57 (0%)
	Above Normal	58	58 (0.4%)	58 (0%)	58 (0.4%)	65 (12.6%)^
	Below Normal	65	65 (0.4%)	65 (0.5%)	65 (0.3%)	66 (2.2%)
	Dry	72	70 (-2.6%)	70 (-2.7%)	70 (-2.7%)	73 (0.4%)
	Critically Dry	83	85 (2.6%)	83 (-0.4%)	83 (-0.4%)	83 (-0.5%)
	All	66	66 (0%)	65 (-0.7%)	65 (-0.6%)	67 (1.9%)
September	Wet	62	62 (-0.1%)	62 (-0.1%)	62 (-0.1%)	62 (-0.1%)
	Above Normal	83	82 (-0.9%)	76 (-8.3%)*	82 (-1%)	70 (-15.6%)*
	Below Normal	125	125 (-0.4%)	124 (-1.1%)	125 (-0.4%)	122 (-2.8%)
	Dry	137	134 (-2.3%)	135 (-1.2%)	134 (-2.3%)	136 (-0.8%)
	Critically Dry	141	138 (-1.6%)	138 (-1.8%)	139 (-1.5%)	138 (-1.6%)
	All	104	103 (-1.2%)	102 (-1.9%)	103 (-1.1%)	101 (-2.8%)
October	Wet	97	96 (-0.1%)	95 (-1.5%)	96 (-0.1%)	94 (-3.1%)
	Above Normal	101	99 (-2.5%)	101 (-0.2%)	99 (-2.5%)	101 (-0.5%)
	Below Normal	108	106 (-2.2%)	105 (-3.1%)	106 (-2.4%)	103 (-4.3%)
	Dry	112	111 (-0.4%)	113 (0.7%)	112 (-0.2%)	108 (-3.2%)
	Critically Dry	120	116 (-3.1%)	119 (-1.1%)	117 (-2.8%)	114 (-4.9%)
	All	106	105 (-1.4%)	105 (-1%)	105 (-1.3%)	103 (-3.3%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Steelhead

Rearing habitat WUA for steelhead was not estimated directly by USFWS (2005b), but was modeled using the rearing WUA curves obtained for late fall–run Chinook salmon, in the same three Sacramento River segments that were used for the winter-run, fall-run and late fall–run spawning and rearing habitat WUA studies (U.S. Fish and Wildlife Service 2003a, 2005b). The rearing WUA curves for late fall–run Chinook salmon were used because the fry rearing period of late fall–run is similar to that of steelhead in the Sacramento River, and because this substitution follows previous practice (Section 11K.2, *Methods*). The validity of using the late fall–run Chinook salmon WUA curves to characterize Central Valley steelhead rearing habitat is uncertain. For this analysis, fry are defined as fish less than 60 mm, and juveniles are young fish (young-of-year) greater than 60 mm.

To estimate changes in rearing WUA that would result from Alternatives 1–3, the late fall–run fry and juvenile WUA curves developed for each of the three river segments was used with mean monthly CALSIM II flow estimates for corresponding river segments under Alternatives 1–3 and the NAA during the rearing periods for steelhead fry (February through May) and juveniles (year-round) in the Sacramento River (Table 11A-8 in Appendix 11A).

Differences in steelhead fry and juvenile rearing habitat WUA in each river segment under Alternatives 1–3 compared to the NAA were examined using the grand mean rearing WUA for each month of the fry and juvenile rearing periods under each water year type and all water year types combined (Table 11K-47 through Table 11K-52). In the tables of results, means that differed by >5% were highlighted in red for >5% reductions or green for >5% increases to flag the largest differences. Note that because the late fall–run fry and juvenile rearing WUA curves were used for the steelhead rearing analyses, as described above, and because the rearing periods for late fall–run and steelhead substantially overlap, the results for steelhead presented here are mostly the same as those presented above for late fall–run fry and juveniles.

Most of the means of Alternatives 1–3 for steelhead fry rearing WUA in all three segments differ from those of the NAA by less than 5% and all means that differ by >5% constitute increases in WUA in comparison to the NAA. In Segments 6 and 5, means increased >5% under Alternatives 1–3 in May of critically dry years (Table 11K-47 and Table 11K-48). In Segment 4, none of the differences were >5% (Table 11K-49). These results indicate that Alternatives 1–3 would have only minor effects or moderate benefits to steelhead fry rearing habitat, depending on month and water year type.

Steelhead juvenile rearing WUA is similar or up to 7% higher under Alternatives 1–3 than under the NAA in Segments 6 and 5 (Table 11K-50 and Table 11K-52), with all increases occurring under Alternative 3. There are many more substantial differences in juvenile rearing WUA between Alternatives 1–3 and the NAA in Segment 4 (Table 11K-52). All but four of the 20 means that differ from the NAA mean >5% in Segment 4 are increases, and one of the four reductions in WUA (September of above normal years under Alternative 3) is large (about 16%). Seven of the increases in rearing WUA are greater than 10%. The 16 large (>5%) increases in juvenile rearing WUA occur in the spring and summer months, especially in May and June (Table 11K-52). The results for steelhead juvenile rearing WUA indicate largely minor differences between Alternatives 1–3 and the NAA for Segments 6 and 5, but substantial differences for Segment 4. This segment would generally result in increased juvenile rearing habitat under Alternatives 1B and 3 during spring and summer, but some reduction in habitat during September and November of above normal years. Alternative 3 would result in the greatest differences, most of which are positive.

Table 11K-47. Steelhead Fry Rearing WUA[a] in the Sacramento River, Segment 6, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
February	Wet	74	74 (-0.1%)	74 (-0.1%)	74 (-0.1%)	74 (-0.1%)
	Above Normal	71	70 (-0.9%)	69 (-1.5%)	70 (-1%)	70 (-0.5%)
	Below Normal	63	62 (-1.8%)	63 (-0.7%)	63 (-0.8%)	62 (-2.4%)
	Dry	62	63 (0.6%)	62 (0.1%)	63 (0.6%)	62 (-0.1%)
	Critically Dry	62	62 (0.4%)	62 (0.4%)	62 (0.4%)	62 (0.4%)
	All	67	67 (-0.3%)	67 (-0.3%)	67 (-0.1%)	67 (-0.4%)
March	Wet	65	65 (0%)	65 (0%)	65 (0%)	65 (0%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	Above Normal	64	64 (-0.2%)	64 (-0.2%)	64 (-0.2%)	64 (-0.3%)
	Below Normal	62	62 (0%)	62 (0%)	62 (0%)	62 (0%)
	Dry	61	62 (0.8%)	61 (-0.3%)	62 (0.9%)	61 (-0.8%)
	Critically Dry	61	61 (-0.2%)	61 (0.1%)	61 (-0.2%)	61 (0.5%)
	All	63	63 (0.1%)	63 (-0.1%)	63 (0.1%)	63 (-0.1%)
April	Wet	93	93 (0%)	93 (0%)	93 (0%)	93 (0%)
	Above Normal	107	107 (0.1%)	106 (-0.5%)	107 (0.1%)	106 (-0.5%)
	Below Normal	117	117 (0.3%)	117 (0.3%)	117 (0.3%)	117 (0.2%)
	Dry	114	116 (1.1%)	115 (0.8%)	116 (1.1%)	116 (0.9%)
	Critically Dry	118	118 (0.5%)	118 (0.1%)	118 (0.5%)	118 (0%)
	All	107	108 (0.4%)	108 (0.2%)	108 (0.4%)	108 (0.2%)
May	Wet	73	73 (-0.1%)	73 (-0.1%)	73 (-0.1%)	73 (-0.1%)
	Above Normal	76	78 (1.8%)	78 (2%)	78 (1.8%)	78 (2%)
	Below Normal	84	85 (1.1%)	88 (4.8%)	85 (1.1%)	87 (3.3%)
	Dry	80	82 (2.4%)	84 (4.7%)	82 (2.5%)	86 (7.7%)^
	Critically Dry	81	86 (6.8%)^	87 (7.5%)^	86 (6.5%)^	89 (10.1%)^
	All	78	80 (2%)	81 (3.4%)	79 (2%)	81 (4.1%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-48. Steelhead Fry Rearing WUA[a] in the Sacramento River, Segment 5, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
February	Wet	1026	1025 (-0.1%)	1025 (-0.1%)	1025 (-0.1%)	1025 (-0.1%)
	Above Normal	1088	1088 (0%)	1090 (0.1%)	1089 (0%)	1102 (1.3%)
	Below Normal	1197	1201 (0.3%)	1184 (-1.1%)	1206 (0.7%)	1170 (-2.3%)
	Dry	1395	1395 (0%)	1396 (0.1%)	1395 (0%)	1395 (0%)
	Critically Dry	1407	1412 (0.4%)	1408 (0.1%)	1409 (0.2%)	1412 (0.4%)
	All	1201	1202 (0.1%)	1199 (-0.2%)	1203 (0.1%)	1199 (-0.2%)
March	Wet	1047	1047 (0%)	1047 (0%)	1047 (0%)	1047 (0%)
	Above Normal	1029	1030 (0%)	1032 (0.2%)	1030 (0%)	1031 (0.2%)
	Below Normal	1352	1352 (0%)	1352 (0%)	1352 (0%)	1352 (0%)
	Dry	1311	1316 (0.4%)	1311 (0.1%)	1315 (0.3%)	1305 (-0.5%)
	Critically Dry	1324	1315 (-0.6%)	1319 (-0.3%)	1316 (-0.6%)	1315 (-0.6%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	All	1195	1195 (0%)	1195 (0%)	1195 (0%)	1193 (-0.2%)
April	Wet	1125	1129 (0.3%)	1129 (0.3%)	1129 (0.3%)	1129 (0.3%)
	Above Normal	1209	1207 (-0.2%)	1196 (-1%)	1207 (-0.2%)	1196 (-1%)
	Below Normal	1332	1339 (0.5%)	1335 (0.2%)	1339 (0.5%)	1323 (-0.7%)
	Dry	1294	1297 (0.2%)	1310 (1.2%)	1297 (0.2%)	1312 (1.3%)
	Critically Dry	1343	1335 (-0.6%)	1337 (-0.5%)	1335 (-0.6%)	1347 (0.3%)
	All	1242	1243 (0.1%)	1244 (0.2%)	1243 (0.1%)	1244 (0.2%)
May	Wet	879	879 (0.1%)	879 (0.1%)	879 (0.1%)	880 (0.1%)
	Above Normal	886	896 (1.1%)	897 (1.2%)	896 (1.1%)	897 (1.2%)
	Below Normal	925	936 (1.2%)	965 (4.3%)	935 (1.1%)	959 (3.7%)
	Dry	919	939 (2.2%)	948 (3.1%)	939 (2.2%)	959 (4.3%)
	Critically Dry	883	938 (6.2%)^	944 (6.9%)^	940 (6.5%)^	954 (8%)^
	All	897	913 (1.8%)	921 (2.7%)	913 (1.8%)	924 (3%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-49. Steelhead Fry Rearing WUA[a] in the Sacramento River, Segment 4, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
February	Wet	151	151 (0%)	151 (0%)	151 (0%)	151 (0%)
	Above Normal	145	145 (0.1%)	145 (0%)	145 (0.1%)	143 (-1.5%)
	Below Normal	158	158 (-0.1%)	158 (-0.2%)	157 (-0.4%)	157 (-1%)
	Dry	178	178 (0.1%)	179 (0.4%)	178 (0.1%)	178 (0.2%)
	Critically Dry	190	191 (0.2%)	190 (0.2%)	190 (0.2%)	191 (0.2%)
	All	163	163 (0.1%)	163 (0.1%)	163 (0%)	163 (-0.3%)
March	Wet	148	148 (0%)	148 (0%)	148 (0%)	148 (0%)
	Above Normal	143	143 (0%)	143 (0%)	143 (0%)	143 (0%)
	Below Normal	176	176 (0%)	176 (0%)	176 (0%)	176 (0%)
	Dry	174	175 (0.3%)	174 (0.1%)	175 (0.3%)	174 (-0.3%)
	Critically Dry	183	183 (-0.1%)	183 (-0.1%)	183 (-0.1%)	183 (-0.1%)
	All	163	163 (0.1%)	163 (0%)	163 (0%)	163 (-0.1%)
April	Wet	153	153 (0.1%)	153 (0.1%)	153 (0.1%)	153 (0.1%)
	Above Normal	167	167 (0%)	166 (-0.2%)	167 (0%)	166 (-0.2%)
	Below Normal	180	180 (0.1%)	181 (0.3%)	180 (0.1%)	180 (0%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	Dry	185	185 (0.3%)	186 (0.7%)	185 (0.3%)	186 (0.8%)
	Critically Dry	194	193 (-0.4%)	193 (-0.4%)	193 (-0.4%)	196 (0.8%)
	All	173	173 (0%)	173 (0.2%)	173 (0%)	173 (0.3%)
May	Wet	143	143 (0.1%)	143 (0.1%)	143 (0.1%)	143 (0.1%)
	Above Normal	151	151 (0.3%)	151 (0.4%)	151 (0.3%)	151 (0.4%)
	Below Normal	161	162 (0.6%)	164 (1.9%)	162 (0.6%)	164 (1.8%)
	Dry	161	162 (1%)	163 (1.5%)	162 (1%)	164 (2.2%)
	Critically Dry	162	168 (3.3%)	168 (3.6%)	168 (3.3%)	168 (3.8%)
	All	154	155 (0.9%)	156 (1.3%)	155 (0.9%)	156 (1.5%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-50. Steelhead Juvenile Rearing WUA[a] in the Sacramento River, Segment 6, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
January	Wet	29	29 (0.1%)	29 (0.1%)	29 (0.2%)	29 (0.1%)
	Above Normal	27	27 (-0.1%)	27 (-0.1%)	27 (-0.1%)	27 (-0.1%)
	Below Normal	31	31 (0%)	31 (0.1%)	31 (0%)	31 (0.1%)
	Dry	32	32 (0.1%)	32 (0.1%)	32 (0.1%)	32 (0.1%)
	Critically Dry	32	32 (-0.8%)	32 (-0.1%)	32 (-0.3%)	32 (-0.7%)
	All	30	30 (-0.1%)	30 (0.1%)	30 (0%)	30 (0%)
February	Wet	30	30 (-0.1%)	30 (-0.1%)	30 (-0.1%)	30 (-0.1%)
	Above Normal	29	29 (-0.8%)	29 (-1.5%)	29 (-0.9%)	28 (-3%)
	Below Normal	29	28 (-0.6%)	29 (0.1%)	29 (-0.3%)	28 (-0.8%)
	Dry	32	32 (0.4%)	32 (0.1%)	32 (0.4%)	32 (-0.2%)
	Critically Dry	32	32 (0.6%)	32 (0.6%)	32 (0.6%)	32 (0.6%)
	All	30	30 (0%)	30 (-0.1%)	30 (0%)	30 (-0.5%)
March	Wet	27	27 (0%)	27 (0%)	27 (0%)	27 (0%)
	Above Normal	27	27 (-0.2%)	27 (-0.5%)	27 (-0.2%)	27 (-0.5%)
	Below Normal	31	31 (0%)	31 (0%)	31 (0%)	31 (0%)
	Dry	32	32 (0.5%)	32 (0.3%)	32 (0.5%)	31 (-0.3%)
	Critically Dry	32	32 (-0.1%)	31 (-0.3%)	32 (-0.1%)	31 (-0.7%)
	All	29	29 (0.1%)	29 (0%)	29 (0.1%)	29 (-0.2%)
April	Wet	38	38 (0%)	38 (0%)	38 (0%)	38 (0%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	Above Normal	41	41 (0%)	41 (0.4%)	41 (0%)	41 (0.4%)
	Below Normal	42	42 (0%)	42 (0.2%)	42 (0%)	42 (0.3%)
	Dry	42	42 (0.3%)	42 (0.7%)	42 (0.3%)	42 (0.8%)
	Critically Dry	41	42 (0.6%)	42 (0.7%)	42 (0.6%)	42 (1.3%)
	All	40	40 (0.2%)	40 (0.3%)	40 (0.2%)	40 (0.5%)
May	Wet	38	38 (0%)	38 (0%)	38 (0%)	38 (0%)
	Above Normal	39	39 (-0.3%)	39 (-0.4%)	39 (-0.3%)	39 (-0.4%)
	Below Normal	41	41 (0%)	41 (0.1%)	41 (0%)	41 (0.6%)
	Dry	41	41 (0.3%)	41 (0.5%)	41 (0.3%)	42 (1%)
	Critically Dry	42	42 (1.4%)	43 (1.7%)	42 (1.4%)	42 (0.7%)
	All	40	40 (0.2%)	40 (0.3%)	40 (0.2%)	40 (0.4%)
June	Wet	41	41 (-0.1%)	41 (-0.1%)	41 (-0.1%)	41 (-0.1%)
	Above Normal	38	38 (0.1%)	39 (4.5%)	38 (0.2%)	40 (5.8%)^
	Below Normal	37	37 (0.2%)	37 (1.2%)	37 (0.2%)	38 (4.1%)
	Dry	35	36 (2.1%)	36 (2%)	36 (2.1%)	36 (2.9%)
	Critically Dry	39	39 (-0.2%)	39 (0.6%)	39 (-0.1%)	39 (0.5%)
	All	38	38 (0.4%)	39 (1.3%)	38 (0.4%)	39 (2.2%)
July	Wet	32	32 (-0.6%)	32 (-0.6%)	32 (-0.6%)	32 (-0.6%)
	Above Normal	32	32 (0.3%)	33 (3.6%)	32 (0.4%)	33 (5.6%)^
	Below Normal	32	32 (-0.5%)	32 (0.5%)	32 (-0.5%)	33 (1.3%)
	Dry	32	32 (-1%)	32 (-1.7%)	32 (-1%)	32 (0%)
	Critically Dry	38	38 (-0.4%)	38 (-0.3%)	38 (-0.3%)	38 (0.3%)
	All	33	33 (-0.5%)	33 (-0.1%)	33 (-0.5%)	33 (0.8%)
August	Wet	35	35 (-0.1%)	35 (-0.1%)	35 (-0.1%)	35 (-0.1%)
	Above Normal	35	35 (0.4%)	35 (-0.3%)	35 (0.4%)	38 (6.7%)^
	Below Normal	38	38 (0.2%)	38 (0.2%)	38 (0.1%)	39 (0.6%)
	Dry	40	39 (-1.7%)	40 (-1.1%)	39 (-1.8%)	40 (0.7%)
	Critically Dry	41	41 (0.3%)	41 (0.1%)	41 (0%)	41 (0%)
	All	38	37 (-0.3%)	37 (-0.3%)	37 (-0.4%)	38 (1.1%)
September	Wet	37	37 (-0.1%)	36 (-0.2%)	37 (-0.1%)	37 (-0.1%)
	Above Normal	41	41 (0.3%)	41 (-0.2%)	41 (0.3%)	41 (-1.5%)
	Below Normal	42	42 (-0.2%)	42 (0.2%)	42 (-0.3%)	42 (-0.2%)
	Dry	41	41 (0.1%)	41 (0.5%)	41 (0.1%)	41 (0.3%)
	Critically Dry	41	41 (0%)	41 (0.2%)	41 (0%)	41 (0.4%)
	All	40	40 (0%)	40 (0.1%)	40 (0%)	40 (-0.1%)
October	Wet	42	42 (0%)	42 (0.1%)	42 (0%)	42 (-0.3%)
	Above Normal	42	42 (0%)	42 (0%)	42 (-0.1%)	42 (-0.7%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	Below Normal	42	42 (0.3%)	42 (0.5%)	42 (0.4%)	42 (0.9%)
	Dry	42	42 (-0.7%)	42 (-0.4%)	42 (-0.7%)	42 (0.4%)
	Critically Dry	41	42 (1.4%)	41 (0.8%)	42 (1.3%)	42 (1.8%)
	All	42	42 (0.1%)	42 (0.1%)	42 (0.1%)	42 (0.3%)
November	Wet	29	29 (-0.4%)	29 (-0.9%)	29 (-0.4%)	29 (-0.9%)
	Above Normal	29	29 (0%)	29 (-0.1%)	29 (0%)	29 (-0.4%)
	Below Normal	30	30 (0.7%)	30 (1%)	30 (0.2%)	30 (0.6%)
	Dry	29	29 (0.6%)	29 (0.5%)	29 (0.6%)	29 (1.2%)
	Critically Dry	30	30 (-0.2%)	30 (-0.3%)	30 (-0.2%)	29 (-1.8%)
	All	29	29 (0.1%)	29 (0%)	29 (0%)	29 (-0.2%)
December	Wet	28	28 (-0.5%)	28 (-0.4%)	28 (-0.5%)	27 (-1.3%)
	Above Normal	29	29 (-0.2%)	29 (-0.1%)	29 (-0.1%)	29 (0.1%)
	Below Normal	31	31 (-0.1%)	31 (-0.1%)	31 (-0.1%)	31 (0%)
	Dry	31	31 (0%)	31 (-0.5%)	31 (0%)	30 (-1.1%)
	Critically Dry	31	31 (-0.5%)	31 (-0.1%)	31 (-0.2%)	31 (-0.4%)
	All	30	30 (-0.3%)	30 (-0.3%)	30 (-0.2%)	29 (-0.7%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-51. Steelhead Juvenile Rearing WUA[a] in the Sacramento River, Segment 5, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
January	Wet	341	341 (0.1%)	341 (0.1%)	341 (0.1%)	341 (0.1%)
	Above Normal	384	384 (0%)	384 (0%)	384 (0%)	384 (0%)
	Below Normal	441	441 (0%)	441 (0.1%)	441 (0%)	441 (0%)
	Dry	460	461 (0.1%)	461 (0.1%)	461 (0.1%)	461 (0.1%)
	Critically Dry	457	455 (-0.4%)	457 (0%)	457 (0%)	458 (0.3%)
	All	407	407 (0%)	408 (0.1%)	407 (0.1%)	408 (0.1%)
February	Wet	344	344 (-0.1%)	344 (-0.1%)	344 (-0.1%)	344 (-0.1%)
	Above Normal	359	357 (-0.6%)	355 (-1.2%)	357 (-0.7%)	352 (-1.9%)
	Below Normal	402	402 (-0.2%)	400 (-0.6%)	404 (0.4%)	395 (-1.8%)
	Dry	459	460 (0.3%)	459 (0%)	460 (0.3%)	459 (-0.1%)
	Critically Dry	463	464 (0.2%)	463 (0.1%)	463 (0.1%)	464 (0.2%)
	All	399	399 (0%)	398 (-0.3%)	399 (0%)	397 (-0.6%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
March	Wet	342	342 (0%)	342 (0%)	342 (0%)	342 (0%)
	Above Normal	357	357 (-0.1%)	356 (-0.4%)	357 (-0.1%)	356 (-0.3%)
	Below Normal	443	443 (0%)	443 (0%)	443 (0%)	443 (0%)
	Dry	446	448 (0.3%)	447 (0.1%)	448 (0.3%)	445 (-0.4%)
	Critically Dry	448	447 (-0.3%)	448 (0%)	447 (-0.3%)	449 (0.2%)
	All	400	400 (0%)	400 (0%)	400 (0%)	400 (-0.1%)
April	Wet	384	385 (0.2%)	385 (0.2%)	385 (0.2%)	385 (0.2%)
	Above Normal	420	420 (-0.1%)	419 (-0.4%)	420 (-0.1%)	419 (-0.4%)
	Below Normal	450	451 (0.2%)	451 (0.1%)	451 (0.2%)	449 (-0.3%)
	Dry	445	446 (0.3%)	448 (0.8%)	446 (0.3%)	449 (0.9%)
	Critically Dry	451	449 (-0.3%)	450 (-0.2%)	449 (-0.3%)	453 (0.4%)
	All	424	424 (0.1%)	425 (0.2%)	424 (0.1%)	425 (0.2%)
May	Wet	334	334 (-0.1%)	334 (-0.1%)	334 (-0.1%)	334 (-0.1%)
	Above Normal	348	349 (0.4%)	349 (0.5%)	349 (0.4%)	349 (0.5%)
	Below Normal	371	374 (0.9%)	380 (2.5%)	374 (0.8%)	380 (2.4%)
	Dry	365	370 (1.3%)	372 (1.9%)	370 (1.3%)	375 (2.9%)
	Critically Dry	365	380 (4.3%)	382 (4.6%)	381 (4.3%)	382 (4.8%)
	All	354	358 (1.1%)	359 (1.6%)	358 (1.1%)	360 (1.8%)
June	Wet	344	345 (0.3%)	345 (0.3%)	345 (0.3%)	345 (0.3%)
	Above Normal	320	321 (0.3%)	333 (4.2%)	321 (0.3%)	338 (5.8%)^
	Below Normal	320	322 (0.6%)	326 (1.7%)	322 (0.6%)	335 (4.7%)
	Dry	311	314 (1.2%)	313 (0.8%)	314 (1.2%)	316 (1.8%)
	Critically Dry	334	333 (-0.1%)	335 (0.4%)	334 (0%)	334 (0.1%)
	All	327	329 (0.5%)	331 (1.2%)	329 (0.5%)	334 (2.1%)
July	Wet	289	289 (-0.3%)	289 (-0.3%)	289 (-0.3%)	289 (-0.3%)
	Above Normal	282	282 (0.1%)	288 (2.1%)	282 (0.1%)	292 (3.5%)
	Below Normal	287	286 (-0.4%)	288 (0.2%)	286 (-0.3%)	289 (0.5%)
	Dry	293	292 (-0.4%)	291 (-0.8%)	292 (-0.4%)	294 (0.3%)
	Critically Dry	328	327 (-0.2%)	328 (-0.1%)	328 (-0.1%)	327 (-0.2%)
	All	294	294 (-0.2%)	295 (0%)	294 (-0.2%)	296 (0.5%)
August	Wet	305	305 (0%)	305 (0%)	305 (0%)	305 (0%)
	Above Normal	308	308 (0.3%)	307 (-0.1%)	308 (0.3%)	323 (5.1%)^
	Below Normal	325	326 (0.2%)	326 (0.2%)	326 (0.1%)	328 (0.8%)
	Dry	339	334 (-1.3%)	335 (-1.1%)	334 (-1.3%)	340 (0.3%)
	Critically Dry	355	358 (0.8%)	354 (-0.2%)	354 (-0.2%)	355 (0%)
	All	324	323 (-0.1%)	323 (-0.3%)	323 (-0.3%)	327 (0.9%)
September	Wet	318	318 (0%)	318 (-0.1%)	318 (0%)	318 (0%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	Above Normal	357	356 (-0.2%)	349 (-2.3%)	356 (-0.3%)	340 (-4.8%)
	Below Normal	410	410 (0%)	408 (-0.6%)	410 (0%)	406 (-1.1%)
	Dry	435	431 (-1%)	431 (-1%)	431 (-0.9%)	433 (-0.5%)
	Critically Dry	445	441 (-1%)	440 (-1.2%)	441 (-1%)	441 (-0.9%)
	All	384	382 (-0.5%)	381 (-0.9%)	382 (-0.4%)	380 (-1.1%)
October	Wet	384	383 (-0.2%)	381 (-0.9%)	383 (-0.2%)	380 (-1%)
	Above Normal	386	385 (-0.4%)	387 (0.1%)	384 (-0.5%)	384 (-0.5%)
	Below Normal	395	392 (-0.7%)	391 (-1%)	392 (-0.8%)	390 (-1.3%)
	Dry	399	400 (0%)	401 (0.3%)	400 (0.1%)	396 (-0.9%)
	Critically Dry	415	409 (-1.4%)	413 (-0.3%)	409 (-1.3%)	404 (-2.6%)
	All	394	392 (-0.4%)	392 (-0.4%)	392 (-0.4%)	389 (-1.2%)
November	Wet	396	395 (-0.2%)	392 (-0.9%)	395 (-0.2%)	394 (-0.3%)
	Above Normal	400	399 (-0.3%)	393 (-1.7%)	399 (-0.2%)	389 (-2.7%)
	Below Normal	410	409 (-0.2%)	410 (-0.1%)	411 (0.2%)	410 (0%)
	Dry	401	402 (0.3%)	404 (0.8%)	402 (0.3%)	402 (0.4%)
	Critically Dry	404	405 (0.3%)	399 (-1.1%)	405 (0.2%)	398 (-1.4%)
	All	401	401 (0%)	399 (-0.6%)	401 (0%)	399 (-0.6%)
December	Wet	346	345 (-0.3%)	346 (-0.1%)	345 (-0.4%)	341 (-1.3%)
	Above Normal	416	415 (-0.2%)	415 (-0.1%)	415 (-0.1%)	418 (0.5%)
	Below Normal	441	441 (0.1%)	441 (0%)	441 (0.1%)	441 (0.1%)
	Dry	439	438 (-0.2%)	432 (-1.4%)	438 (-0.2%)	426 (-2.8%)
	Critically Dry	452	454 (0.4%)	453 (0.1%)	452 (0%)	451 (-0.2%)
	All	408	408 (-0.1%)	407 (-0.3%)	408 (-0.2%)	404 (-1%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

Table 11K-52. Steelhead Juvenile Rearing WUA[a] in the Sacramento River, Segment 4, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3).

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
January	Wet	56	56 (0.4%)	56 (0.4%)	56 (0.4%)	56 (0.4%)
	Above Normal	64	64 (0%)	64 (0%)	64 (0%)	64 (0%)
	Below Normal	101	101 (-0.1%)	101 (0.3%)	101 (0%)	101 (0.4%)
	Dry	129	129 (0.2%)	129 (0.2%)	129 (0.2%)	129 (0.2%)
	Critically Dry	130	128 (-1.5%)	130 (0.1%)	130 (-0.2%)	131 (1%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
	All	92	91 (-0.2%)	92 (0.2%)	92 (0.1%)	92 (0.4%)
February	Wet	57	57 (-0.1%)	57 (-0.1%)	57 (-0.1%)	57 (-0.1%)
	Above Normal	58	58 (0.3%)	59 (0.4%)	59 (0.3%)	58 (-0.7%)
	Below Normal	86	86 (0.3%)	86 (0%)	86 (0.5%)	86 (0%)
	Dry	114	115 (0.3%)	115 (0.4%)	115 (0.3%)	114 (0.1%)
	Critically Dry	132	133 (0.9%)	133 (0.7%)	133 (0.7%)	134 (0.9%)
	All	86	86 (0.4%)	86 (0.3%)	86 (0.4%)	86 (0.2%)
March	Wet	60	60 (0%)	60 (0%)	60 (0%)	60 (0%)
	Above Normal	64	64 (0.1%)	64 (0.2%)	64 (0.1%)	64 (0.2%)
	Below Normal	114	114 (0%)	114 (0%)	114 (0%)	114 (0%)
	Dry	109	109 (0.2%)	109 (0.2%)	109 (0.1%)	109 (0.1%)
	Critically Dry	125	124 (-0.9%)	125 (-0.3%)	124 (-0.9%)	125 (0%)
	All	90	90 (-0.1%)	90 (0%)	90 (-0.1%)	90 (0.1%)
April	Wet	78	78 (0.5%)	78 (0.5%)	78 (0.5%)	78 (0.5%)
	Above Normal	98	98 (-0.2%)	97 (-0.9%)	98 (-0.2%)	97 (-0.9%)
	Below Normal	118	118 (0.3%)	118 (0.3%)	118 (0.3%)	118 (0%)
	Dry	123	125 (1%)	126 (2.5%)	125 (1%)	127 (2.7%)
	Critically Dry	135	136 (0.7%)	136 (0.9%)	136 (0.7%)	138 (1.9%)
	All	106	107 (0.5%)	107 (0.9%)	107 (0.5%)	107 (1%)
May	Wet	60	60 (0.6%)	60 (0.6%)	60 (0.6%)	60 (0.7%)
	Above Normal	68	69 (1.7%)	69 (1.9%)	69 (1.7%)	69 (1.9%)
	Below Normal	80	82 (2.6%)	86 (8.5%)^	82 (2.6%)	86 (8.7%)^
	Dry	81	84 (3.7%)	85 (5.5%)^	84 (3.7%)	88 (8.3%)^
	Critically Dry	81	91 (11.7%)^	92 (13%)^	91 (11.9%)^	92 (13.3%)^
	All	72	75 (3.7%)	76 (5.5%)^	75 (3.8%)	77 (6.3%)^
June	Wet	64	64 (1.1%)	64 (1.1%)	64 (1.1%)	64 (1.1%)
	Above Normal	57	58 (0.8%)	62 (9.2%)^	58 (0.8%)	65 (13.6%)^
	Below Normal	59	60 (2%)	62 (4.6%)	60 (2%)	67 (12.7%)^
	Dry	58	59 (2.7%)	59 (1.9%)	59 (2.6%)	60 (4.4%)
	Critically Dry	68	67 (-0.3%)	68 (0.7%)	68 (0.1%)	67 (-0.4%)
	All	61	62 (1.3%)	63 (2.9%)	62 (1.4%)	64 (5.2%)^
July	Wet	50	50 (-0.3%)	50 (-0.3%)	50 (1.4%)	50 (-0.3%)
	Above Normal	47	47 (0.2%)	49 (4.2%)	47 (1.4%)	50 (7.3%)^
	Below Normal	49	49 (-0.8%)	49 (0.1%)	49 (1.4%)	50 (0.9%)
	Dry	53	52 (-1.1%)	52 (-1.7%)	52 (1.4%)	53 (0.5%)
	Critically Dry	67	67 (-0.3%)	67 (-0.1%)	67 (1.4%)	67 (-0.9%)
	All	53	52 (-0.5%)	53 (0%)	52 (1.4%)	53 (0.9%)

Month	Water Year Type	NAA	Alt 1A	Alt 1B	Alt 2	Alt 3
August	Wet	56	57 (0%)	57 (0%)	57 (1.4%)	57 (0%)
	Above Normal	58	58 (0.4%)	58 (0%)	58 (1.4%)	65 (12.6%)^
	Below Normal	65	65 (0.4%)	65 (0.5%)	65 (1.4%)	66 (2.2%)
	Dry	72	70 (-2.6%)	70 (-2.7%)	70 (1.4%)	73 (0.4%)
	Critically Dry	83	85 (2.6%)	83 (-0.4%)	83 (1.4%)	83 (-0.5%)
	All	66	66 (0%)	65 (-0.7%)	65 (1.4%)	67 (1.9%)
September	Wet	62	62 (-0.1%)	62 (-0.1%)	62 (1.4%)	62 (-0.1%)
	Above Normal	83	82 (-0.9%)	76 (-8.3%)*	82 (1.4%)	70 (-15.6%)*
	Below Normal	125	125 (-0.4%)	124 (-1.1%)	125 (1.4%)	122 (-2.8%)
	Dry	137	134 (-2.3%)	135 (-1.2%)	134 (1.4%)	136 (-0.8%)
	Critically Dry	141	138 (-1.6%)	138 (-1.8%)	139 (1.4%)	138 (-1.6%)
	All	104	103 (-1.2%)	102 (-1.9%)	103 (1.4%)	101 (-2.8%)
October	Wet	97	96 (-0.1%)	95 (-1.5%)	96 (1.4%)	94 (-3.1%)
	Above Normal	101	99 (-2.5%)	101 (-0.2%)	99 (1.4%)	101 (-0.5%)
	Below Normal	108	106 (-2.2%)	105 (-3.1%)	106 (1.4%)	103 (-4.3%)
	Dry	112	111 (-0.4%)	113 (0.7%)	112 (1.4%)	108 (-3.2%)
	Critically Dry	120	116 (-3.1%)	119 (-1.1%)	117 (1.4%)	114 (-4.9%)
	All	106	105 (-1.4%)	105 (-1%)	105 (1.4%)	103 (-3.3%)
November	Wet	96	96 (-0.4%)	95 (-1.2%)	96 (1.4%)	96 (0%)
	Above Normal	102	101 (-0.5%)	97 (-5%)*	101 (1.4%)	94 (-7.4%)*
	Below Normal	112	111 (-0.5%)	112 (0.1%)	113 (1.4%)	112 (0.6%)
	Dry	104	105 (0.7%)	107 (2.2%)	105 (1.4%)	106 (1.2%)
	Critically Dry	110	113 (2.5%)	109 (-1.2%)	113 (1.4%)	109 (-1.3%)
	All	104	104 (0.2%)	103 (-0.8%)	104 (1.4%)	103 (-0.9%)
December	Wet	63	63 (-0.2%)	63 (0.3%)	63 (1.4%)	62 (-2%)
	Above Normal	104	104 (-0.4%)	104 (-0.2%)	104 (1.4%)	105 (1%)
	Below Normal	124	124 (0.2%)	124 (0.2%)	124 (1.4%)	124 (0.3%)
	Dry	116	116 (0.1%)	114 (-1.6%)	116 (1.4%)	111 (-4%)
	Critically Dry	134	136 (1.6%)	135 (0.5%)	135 (1.4%)	135 (0.3%)
	All	101	102 (0.3%)	101 (-0.2%)	101 (1.4%)	100 (-1.1%)

[a] WUA results are given in thousands of WUA units to save space.

* Results for which WUA under Alternative 1, 2, or 3 is more than 5% above WUA under the NAA are highlighted green.

^ Results for which WUA under Alternative 1, 2, or 3 is more than 5% below WUA under the NAA are highlighted red.

11K.4 Conclusions

WUA analysis was used to estimate the amount of spawning and rearing habitat available to the Chinook salmon races and steelhead in the upper Sacramento River downstream of Keswick Dam. Spawning habitat WUA analysis was also used to estimate spawning habitat in the Feather River High Flow Channel (downstream of Thermalito Afterbay outlet) and the American River downstream of Nimbus Dam. The results of the analyses suggest that Alternatives 1–3 would cause few large changes in spawning WUA in any of the rivers and would generally result in more increases than reductions in rearing WUA in the Sacramento River, especially for juveniles (53% increases in total). Spring-run and fall-run had the most reductions in spawning WUA, but all the largest reductions were less than 10% (Table 11K-5 through Table 11K-10). Alternatives 1 and 2 would lead to the fewest changes in spawning or rearing WUA and Alternative 3 would result in the most frequent large changes, both reductions and increases.

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