Section 5C.5.2
Upstream Habitat Results

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5C.5.2 Upstream Habitat Results

5C.5.2.1 Mainstem Sacramento River

5C.5.2.1.1 Steelhead

Existing wild steelhead stocks inhabit the upper Sacramento River, primarily upstream of Red Bluff Diversion Dam to Keswick, and its tributaries, including Antelope, Deer, and Mill Creeks and the Yuba River. Populations may exist in Big Chico and Butte Creeks. Of these waterways, only the mainstem Sacramento River has the potential to be affected by BDCP because flows in other waterways are not influenced by CVP/SWP operations.

5C.5.2.1.1.1 Eggs and Alevins

Upstream Spawning Habitat

The two primary potential effects of Bay Delta Conservation Plan (BDCP) operations on habitat conditions for steelhead spawning and egg incubation on the mainstem Sacramento River relate to changes in either instream flows or seasonal water temperatures released from Shasta and Keswick Dams. The primary spawning and egg incubation period extends from December through June (National Marine Fisheries Service 2009). Results of the CALSIM analyses of instream flows within the reach where the majority of steelhead spawning occurs (Keswick Dam to upstream of Red Bluff Diversion Dam [RBDD]) were compared among model scenarios by month and water-year type. Average flows by month and water-year type for each model scenario in the Sacramento River at Keswick and upstream of RBDD are presented in Table 5C.5.2-1 and Table 5C.5.2-2, respectively, and differences between pairs of model scenarios are presented in Table 5C.5.2-3 and Table 5C.5.2-4, respectively. Monthly frequency of exceedance plots for Sacramento River flows at Keswick and upstream of RBDD for all months are presented in Figure 5C.5.2-1 through Figure 5C.5.2-12 and in Figure 5C.5.2-13 through Figure 5C.5.2-24, respectively, and specifically during the primary steelhead spawning and egg incubation period (January through April) in Figure 5C.5.2-1 through Figure 5C.5.2-4 at Keswick and in Figure 5C.5.2-13 through Figure 5C.5.2-16 upstream of RBDD. For each month and water-year type at both locations, flows under the evaluated starting operations in the early long-term (ESO_ELT) and late long-term (ESO_LLT) are predicted to be generally greater than or similar to those under the existing biological conditions in the early long term (EBC2_ELT) and late long-term (EBC2_LLT), respectively, indicating that the effects of the ESO on Sacramento River flows independent of climate change would be small. One exception is November, during which average flows would be 5%–23% lower under the ESO_LLT relative to EBC2_LLT depending on location and water-year type. This is primarily a result of changes in Keswick releases needed to meet Fall X2 requirements under ESO. The changes in upstream flows under ESO compared to EBC2 are generally driven by a shift in the export patterns caused by availability of conveyance capacity and changes in the export constraints. However, the change in Noemberv is primarily driven by reduction in exports in the fall months and increase in Delta outflow because of south Delta constraints, thereby not needing as high of upstream releases under ESO as under EBC2 to meet the X2 requirements. Regardless, November is not a month during which steelhead spawning and egg incubation occurs. Therefore, there would be no effects of this decrease on steelhead spawning and egg incubation in the Sacramento River.

Table 5C.5.2-1. Mean Monthly Flows (cfs) in the Sacramento River at Keswick under EBC and ESO Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	16,526	15,889	17,330	18,233	17,764	18,545
	AN	8,318	7,634	7,776	8,205	8,471	7,795
	BN	4,502	4,285	4,340	4,184	4,918	4,342
	D	3,996	3,873	4,098	4,096	4,098	3,803
	C	3,490	3,673	3,794	4,238	3,516	4,364
	All	8,614	8,274	8,829	9,215	9,126	9,235
Feb	W	18,577	18,356	20,349	20,853	20,494	20,888
	AN	14,409	14,184	15,081	15,297	15,912	15,871
	BN	5,981	5,701	6,456	5,544	6,808	6,301
	D	3,684	3,738	3,447	3,410	3,506	3,407
	C	3,599	3,600	3,394	3,372	3,510	3,358
	All	10,355	10,217	11,015	11,039	11,272	11,261
Mar	W	16,200	16,195	16,399	17,065	16,408	17,139
	AN	9,131	8,429	8,662	8,818	9,205	8,803
	BN	5,200	4,756	4,306	4,318	4,472	4,252
	D	3,903	3,872	3,858	3,814	3,771	3,753
	C	3,487	3,617	3,608	3,583	3,802	3,842
	All	8,728	8,560	8,577	8,800	8,697	8,834
Apr	W	9,418	9,396	9,254	9,131	9,242	9,009
	AN	6,182	6,093	5,712	5,536	5,822	5,827
	BN	5,426	5,167	4,934	5,009	5,000	5,414
	D	5,803	5,578	5,497	5,533	5,633	5,776
	C	6,472	6,298	6,343	6,550	6,313	6,498
	All	7,038	6,899	6,748	6,733	6,797	6,852
May	W	9,508	9,450	8,183	7,149	8,191	7,541
	AN	7,709	7,692	7,307	7,783	8,189	8,971
	BN	7,193	6,954	6,411	6,272	6,810	7,169
	D	7,349	7,175	7,075	7,681	7,496	8,608
	C	6,715	6,639	6,900	7,316	6,920	7,499
	All	7,967	7,856	7,321	7,233	7,616	7,915
Jun	W	10,375	10,463	10,063	10,274	10,321	11,240
	AN	11,147	11,369	11,403	12,032	12,068	13,610
	BN	10,758	10,752	10,573	10,947	11,267	11,711
	D	11,224	11,251	11,464	11,898	12,141	12,648
	C	10,392	10,598	11,041	11,350	11,252	11,456
	All	10,742	10,838	10,797	11,160	11,274	12,008

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jul	W	12,779	12,947	13,477	14,098	13,698	14,230
	AN	14,056	14,313	14,541	15,098	14,615	14,940
	BN	12,965	13,021	13,195	13,177	13,673	13,020
	D	13,302	13,451	13,650	13,727	13,653	12,764
	C	12,849	12,597	12,124	11,935	12,471	11,605
	All	13,123	13,219	13,424	13,689	13,639	13,421
Aug	W	11,029	11,012	10,447	10,491	10,520	10,445
	AN	10,449	10,695	10,835	11,641	11,165	11,287
	BN	10,139	10,201	9,876	10,261	10,757	10,172
	D	10,627	10,775	10,464	10,986	9,380	9,420
	C	9,473	9,517	8,380	7,348	8,093	6,761
	All	10,476	10,557	10,108	10,269	10,049	9,757
Sep	W	9,385	12,374	12,012	12,833	11,720	13,194
	AN	5,862	8,183	9,209	9,898	7,834	9,315
	BN	5,492	5,472	5,677	5,601	5,156	4,836
	D	5,985	5,660	4,982	4,469	4,543	5,053
	C	5,563	5,276	4,827	4,368	4,717	5,239
	All	6,899	8,070	7,926	8,094	7,430	8,248
Oct	W	6,886	6,530	6,491	7,034	6,408	6,895
	AN	7,145	6,313	6,090	7,152	5,750	7,247
	BN	6,396	6,328	5,835	7,072	5,662	6,435
	D	6,128	5,922	5,899	6,494	5,862	6,326
	C	5,902	5,613	5,452	5,752	5,161	5,610
	All	6,530	6,196	6,038	6,752	5,882	6,555
Nov	W	6,672	7,721	7,620	7,539	6,493	6,369
	AN	6,224	6,917	7,357	7,134	5,716	5,469
	BN	5,088	5,783	5,926	5,936	4,553	4,845
	D	5,669	5,408	5,439	5,406	4,627	4,535
	C	4,822	4,874	4,789	4,710	4,437	4,413
	All	5,845	6,348	6,399	6,324	5,337	5,288
Dec	W	12,766	11,441	12,808	11,022	12,958	10,870
	AN	5,531	5,482	5,729	5,377	5,370	5,472
	BN	5,413	5,200	5,857	5,195	5,667	5,500
	D	4,215	3,915	3,883	3,936	3,877	3,973
	C	3,828	3,534	3,593	3,582	3,703	3,613
	All	7,267	6,694	7,278	6,557	7,255	6,587

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-2. Differences between EBC and ESO Scenarios in Mean Monthly Flows (cfs) in the Sacramento River at Keswick

Month	Water-Year Type[a]	Scenarios[b]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	1238 (7.5%)	2018 (12.2%)	1875 (11.8%)	2656 (16.7%)	434 (2.5%)	311 (1.7%)
	AN	154 (1.8%)	-522 (-6.3%)	837 (11%)	161 (2.1%)	695 (8.9%)	-409 (-5%)
	BN	416 (9.2%)	-160 (-3.5%)	632 (14.8%)	57 (1.3%)	577 (13.3%)	159 (3.8%)
	D	103 (2.6%)	-193 (-4.8%)	225 (5.8%)	-71 (-1.8%)	0 (0%)	-293 (-7.2%)
	C	26 (0.7%)	873 (25%)	-156 (-4.3%)	691 (18.8%)	-278 (-7.3%)	126 (3%)
	All	512 (5.9%)	622 (7.2%)	852 (10.3%)	961 (11.6%)	297 (3.4%)	20 (0.2%)
Feb	W	1917 (10.3%)	2311 (12.4%)	2139 (11.7%)	2532 (13.8%)	145 (0.7%)	34 (0.2%)
	AN	1503 (10.4%)	1461 (10.1%)	1728 (12.2%)	1686 (11.9%)	832 (5.5%)	574 (3.8%)
	BN	827 (13.8%)	320 (5.3%)	1107 (19.4%)	600 (10.5%)	352 (5.5%)	757 (13.7%)
	D	-178 (-4.8%)	-276 (-7.5%)	-232 (-6.2%)	-331 (-8.9%)	59 (1.7%)	-2 (-0.1%)
	C	-88 (-2.5%)	-241 (-6.7%)	-90 (-2.5%)	-242 (-6.7%)	116 (3.4%)	-15 (-0.4%)
	All	917 (8.9%)	905 (8.7%)	1056 (10.3%)	1044 (10.2%)	258 (2.3%)	221 (2%)
Mar	W	208 (1.3%)	939 (5.8%)	212 (1.3%)	944 (5.8%)	9 (0.1%)	73 (0.4%)
	AN	74 (0.8%)	-328 (-3.6%)	776 (9.2%)	374 (4.4%)	543 (6.3%)	-15 (-0.2%)
	BN	-727 (-14%)	-948 (-18.2%)	-284 (-6%)	-504 (-10.6%)	166 (3.8%)	-66 (-1.5%)
	D	-133 (-3.4%)	-150 (-3.9%)	-101 (-2.6%)	-119 (-3.1%)	-88 (-2.3%)	-61 (-1.6%)
	C	314 (9%)	355 (10.2%)	185 (5.1%)	226 (6.2%)	194 (5.4%)	259 (7.2%)
	All	-31 (-0.4%)	107 (1.2%)	137 (1.6%)	275 (3.2%)	120 (1.4%)	34 (0.4%)
Apr	W	-176 (-1.9%)	-409 (-4.3%)	-154 (-1.6%)	-387 (-4.1%)	-12 (-0.1%)	-122 (-1.3%)
	AN	-360 (-5.8%)	-355 (-5.7%)	-271 (-4.5%)	-267 (-4.4%)	110 (1.9%)	291 (5.3%)
	BN	-426 (-7.8%)	-12 (-0.2%)	-167 (-3.2%)	247 (4.8%)	66 (1.3%)	406 (8.1%)
	D	-169 (-2.9%)	-27 (-0.5%)	55 (1%)	198 (3.5%)	136 (2.5%)	243 (4.4%)
	C	-159 (-2.5%)	26 (0.4%)	15 (0.2%)	200 (3.2%)	-30 (-0.5%)	-53 (-0.8%)
	All	-242 (-3.4%)	-186 (-2.6%)	-103 (-1.5%)	-47 (-0.7%)	49 (0.7%)	119 (1.8%)
May	W	-1317 (-13.9%)	-1967 (-20.7%)	-1259 (-13.3%)	-1909 (-20.2%)	8 (0.1%)	392 (5.5%)
	AN	480 (6.2%)	1263 (16.4%)	496 (6.5%)	1279 (16.6%)	882 (12.1%)	1188 (15.3%)
	BN	-383 (-5.3%)	-24 (-0.3%)	-144 (-2.1%)	216 (3.1%)	398 (6.2%)	898 (14.3%)
	D	147 (2%)	1259 (17.1%)	321 (4.5%)	1433 (20%)	421 (5.9%)	927 (12.1%)
	C	205 (3%)	784 (11.7%)	281 (4.2%)	861 (13%)	19 (0.3%)	184 (2.5%)
	All	-351 (-4.4%)	-52 (-0.7%)	-240 (-3.1%)	59 (0.8%)	295 (4%)	682 (9.4%)
Jun	W	-54 (-0.5%)	865 (8.3%)	-141 (-1.4%)	778 (7.4%)	259 (2.6%)	966 (9.4%)
	AN	921 (8.3%)	2462 (22.1%)	699 (6.2%)	2241 (19.7%)	665 (5.8%)	1578 (13.1%)
	BN	509 (4.7%)	952 (8.9%)	515 (4.8%)	959 (8.9%)	693 (6.6%)	763 (7%)
	D	917 (8.2%)	1425 (12.7%)	890 (7.9%)	1398 (12.4%)	678 (5.9%)	750 (6.3%)
	C	860 (8.3%)	1064 (10.2%)	654 (6.2%)	858 (8.1%)	211 (1.9%)	106 (0.9%)
	All	532 (4.9%)	1266 (11.8%)	437 (4%)	1171 (10.8%)	477 (4.4%)	848 (7.6%)
Jul	W	919 (7.2%)	1451 (11.4%)	752 (5.8%)	1283 (9.9%)	222 (1.6%)	132 (0.9%)
	AN	559 (4%)	884 (6.3%)	302 (2.1%)	627 (4.4%)	74 (0.5%)	-158 (-1%)
	BN	708 (5.5%)	54 (0.4%)	653 (5%)	-1 (0%)	478 (3.6%)	-157 (-1.2%)
	D	351 (2.6%)	-538 (-4%)	202 (1.5%)	-687 (-5.1%)	4 (0%)	-963 (-7%)
	C	-379 (-2.9%)	-1245 (-9.7%)	-126 (-1%)	-992 (-7.9%)	347 (2.9%)	-330 (-2.8%)
	All	516 (3.9%)	298 (2.3%)	420 (3.2%)	202 (1.5%)	214 (1.6%)	-268 (-2%)

Month	Water-Year Type[a]	Scenarios[b]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Aug	W	-509 (-4.6%)	-584 (-5.3%)	-492 (-4.5%)	-567 (-5.1%)	73 (0.7%)	-45 (-0.4%)
	AN	716 (6.9%)	838 (8%)	470 (4.4%)	592 (5.5%)	330 (3%)	-354 (-3%)
	BN	617 (6.1%)	32 (0.3%)	555 (5.4%)	-29 (-0.3%)	880 (8.9%)	-89 (-0.9%)
	D	-1247 (-11.7%)	-1208 (-11.4%)	-1395 (-12.9%)	-1356 (-12.6%)	-1084 (-10.4%)	-1566 (-14.3%)
	C	-1380 (-14.6%)	-2712 (-28.6%)	-1425 (-15%)	-2757 (-29%)	-287 (-3.4%)	-587 (-8%)
	All	-427 (-4.1%)	-719 (-6.9%)	-507 (-4.8%)	-799 (-7.6%)	-58 (-0.6%)	-511 (-5%)
Sep	W	2335 (24.9%)	3809 (40.6%)	-654 (-5.3%)	820 (6.6%)	-292 (-2.4%)	361 (2.8%)
	AN	1971 (33.6%)	3452 (58.9%)	-349 (-4.3%)	1132 (13.8%)	-1376 (-14.9%)	-583 (-5.9%)
	BN	-336 (-6.1%)	-656 (-11.9%)	-315 (-5.8%)	-635 (-11.6%)	-521 (-9.2%)	-765 (-13.7%)
	D	-1442 (-24.1%)	-933 (-15.6%)	-1117 (-19.7%)	-608 (-10.7%)	-439 (-8.8%)	584 (13.1%)
	C	-846 (-15.2%)	-324 (-5.8%)	-559 (-10.6%)	-37 (-0.7%)	-109 (-2.3%)	871 (19.9%)
	All	531 (7.7%)	1349 (19.5%)	-639 (-7.9%)	178 (2.2%)	-495 (-6.2%)	154 (1.9%)
Oct	W	-478 (-6.9%)	9 (0.1%)	-123 (-1.9%)	364 (5.6%)	-84 (-1.3%)	-140 (-2%)
	AN	-1395 (-19.5%)	102 (1.4%)	-563 (-8.9%)	934 (14.8%)	-340 (-5.6%)	95 (1.3%)
	BN	-734 (-11.5%)	39 (0.6%)	-666 (-10.5%)	107 (1.7%)	-173 (-3%)	-637 (-9%)
	D	-266 (-4.3%)	198 (3.2%)	-60 (-1%)	404 (6.8%)	-37 (-0.6%)	-168 (-2.6%)
	C	-741 (-12.6%)	-293 (-5%)	-452 (-8%)	-3 (-0.1%)	-291 (-5.3%)	-142 (-2.5%)
	All	-648 (-9.9%)	25 (0.4%)	-314 (-5.1%)	359 (5.8%)	-156 (-2.6%)	-197 (-2.9%)
Nov	W	-180 (-2.7%)	-304 (-4.5%)	-1229 (-15.9%)	-1352 (-17.5%)	-1127 (-14.8%)	-1170 (-15.5%)
	AN	-508 (-8.2%)	-755 (-12.1%)	-1201 (-17.4%)	-1449 (-20.9%)	-1641 (-22.3%)	-1665 (-23.3%)
	BN	-534 (-10.5%)	-242 (-4.8%)	-1230 (-21.3%)	-938 (-16.2%)	-1373 (-23.2%)	-1090 (-18.4%)
	D	-1042 (-18.4%)	-1134 (-20%)	-781 (-14.4%)	-874 (-16.2%)	-812 (-14.9%)	-871 (-16.1%)
	C	-386 (-8%)	-410 (-8.5%)	-438 (-9%)	-462 (-9.5%)	-352 (-7.4%)	-297 (-6.3%)
	All	-508 (-8.7%)	-557 (-9.5%)	-1011 (-15.9%)	-1060 (-16.7%)	-1062 (-16.6%)	-1036 (-16.4%)
Dec	W	192 (1.5%)	-1896 (-14.9%)	1517 (13.3%)	-571 (-5%)	150 (1.2%)	-153 (-1.4%)
	AN	-161 (-2.9%)	-59 (-1.1%)	-112 (-2%)	-9 (-0.2%)	-359 (-6.3%)	95 (1.8%)
	BN	254 (4.7%)	87 (1.6%)	467 (9%)	300 (5.8%)	-190 (-3.3%)	306 (5.9%)
	D	-338 (-8%)	-242 (-5.7%)	-38 (-1%)	58 (1.5%)	-6 (-0.2%)	37 (0.9%)
	C	-125 (-3.3%)	-215 (-5.6%)	169 (4.8%)	79 (2.2%)	110 (3.1%)	31 (0.9%)
	All	-12 (-0.2%)	-679 (-9.3%)	561 (8.4%)	-107 (-1.6%)	-23 (-0.3%)	30 (0.5%)

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-3. Mean Monthly Flows (cfs) in the Sacramento River upstream of Red Bluff Diversion Dam under EBC and ESO Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	28,036	27,416	29,368	30,390	29,799	30,699
	AN	16,725	16,067	16,267	16,885	16,960	16,472
	BN	9,381	9,215	9,267	9,146	9,842	9,299
	D	7,098	7,028	7,262	7,262	7,261	6,967
	C	6,143	6,389	6,497	6,942	6,222	7,077
	All	15,396	15,095	15,819	16,278	16,115	16,297
Feb	W	30,255	30,054	32,712	33,472	32,853	33,502
	AN	23,492	23,295	24,422	24,828	25,247	25,402
	BN	12,005	11,748	12,508	11,614	12,855	12,368
	D	8,947	9,030	8,785	8,790	8,843	8,788
	C	6,599	6,643	6,404	6,378	6,527	6,365
	All	18,010	17,899	18,947	19,092	19,203	19,312
Mar	W	25,004	25,034	25,473	26,210	25,481	26,282
	AN	16,599	15,943	16,222	16,428	16,753	16,409
	BN	9,333	8,924	8,438	8,474	8,598	8,402
	D	8,385	8,392	8,349	8,300	8,260	8,238
	C	5,999	6,175	6,126	6,101	6,323	6,362
	All	14,669	14,540	14,621	14,876	14,738	14,909
Apr	W	15,172	15,191	15,078	14,842	15,066	14,719
	AN	10,477	10,423	9,983	9,761	10,090	10,051
	BN	8,711	8,496	8,239	8,282	8,299	8,689
	D	7,948	7,763	7,654	7,661	7,789	7,902
	C	7,742	7,611	7,628	7,829	7,600	7,777
	All	10,709	10,610	10,445	10,376	10,493	10,494
May	W	12,541	12,504	11,224	10,073	11,232	10,464
	AN	10,012	10,017	9,623	10,047	10,502	11,230
	BN	8,781	8,580	8,030	7,875	8,423	8,768
	D	8,677	8,540	8,424	9,012	8,841	9,935
	C	7,746	7,721	7,956	8,348	7,975	8,533
	All	9,979	9,900	9,351	9,208	9,644	9,888
Jun	W	11,905	12,002	11,591	11,720	11,849	12,681
	AN	12,001	12,225	12,227	12,789	12,882	14,358
	BN	11,464	11,496	11,304	11,651	11,988	12,406
	D	11,777	11,834	12,028	12,441	12,699	13,183
	C	10,885	11,123	11,539	11,881	11,748	11,937
	All	11,666	11,783	11,723	12,046	12,196	12,881
Jul	W	13,255	13,418	13,937	14,525	14,157	14,651
	AN	14,129	14,381	14,594	15,142	14,662	14,975
	BN	13,011	13,090	13,272	13,258	13,741	13,098
	D	13,368	13,541	13,741	13,826	13,737	12,859
	C	13,005	12,771	12,344	12,149	12,632	11,851

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
	All	13,329	13,435	13,643	13,898	13,845	13,630
Aug	W	11,284	11,261	10,700	10,735	10,773	10,689
	AN	10,580	10,824	10,968	11,775	11,295	11,424
	BN	10,202	10,285	9,971	10,364	10,845	10,277
	D	10,747	10,913	10,610	11,143	9,524	9,582
	C	9,590	9,656	8,632	7,665	8,326	7,128
	All	10,630	10,719	10,292	10,464	10,229	9,962
Sep	W	9,856	12,843	12,494	13,312	12,202	13,674
	AN	6,279	8,606	9,634	10,320	8,255	9,739
	BN	5,821	5,824	6,038	5,963	5,510	5,201
	D	6,391	6,098	5,424	4,911	4,991	5,505
	C	5,887	5,645	5,279	4,838	5,112	5,727
	All	7,302	8,491	8,365	8,535	7,862	8,695
Oct	W	8,020	7,686	7,662	8,188	7,585	8,048
	AN	8,112	7,306	7,108	8,162	6,773	8,257
	BN	7,094	7,038	6,544	7,778	6,376	7,146
	D	6,903	6,716	6,690	7,287	6,648	7,107
	C	6,670	6,420	6,254	6,537	5,951	6,411
	All	7,432	7,122	6,971	7,675	6,815	7,478
Nov	W	9,876	11,032	10,966	10,821	9,839	9,653
	AN	8,144	8,918	9,362	9,098	7,725	7,430
	BN	6,791	7,565	7,710	7,682	6,338	6,597
	D	7,548	7,370	7,421	7,347	6,601	6,480
	C	5,811	5,905	5,805	5,703	5,456	5,416
	All	7,990	8,576	8,642	8,521	7,580	7,489
Dec	W	21,015	19,736	21,554	19,613	21,714	19,469
	AN	10,019	10,030	10,370	10,053	10,021	10,161
	BN	8,408	8,235	8,921	8,228	8,741	8,541
	D	7,292	7,053	7,044	7,091	7,046	7,137
	C	5,628	5,393	5,465	5,433	5,582	5,480
	All	11,989	11,469	12,221	11,446	12,207	11,487

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-4. Differences between EBC and ESO Scenarios in Mean Monthly Flows (cfs) in the Sacramento River upstream of the Red Bluff Diversion Dam

Month	Water-Year Type[a]	Scenarios[b]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	1762 (6.3%)	2663 (9.5%)	2383 (8.7%)	3284 (12%)	431 (1.5%)	309 (1%)
	AN	236 (1.4%)	-252 (-1.5%)	894 (5.6%)	405 (2.5%)	694 (4.3%)	-413 (-2.4%)
	BN	460 (4.9%)	-82 (-0.9%)	627 (6.8%)	84 (0.9%)	574 (6.2%)	153 (1.7%)
	D	163 (2.3%)	-131 (-1.8%)	233 (3.3%)	-62 (-0.9%)	-1 (0%)	-295 (-4.1%)
	C	79 (1.3%)	934 (15.2%)	-166 (-2.6%)	689 (10.8%)	-275 (-4.2%)	135 (1.9%)
	All	719 (4.7%)	901 (5.9%)	1020 (6.8%)	1202 (8%)	296 (1.9%)	19 (0.1%)
Feb	W	2598 (8.6%)	3247 (10.7%)	2799 (9.3%)	3448 (11.5%)	142 (0.4%)	30 (0.1%)
	AN	1756 (7.5%)	1910 (8.1%)	1952 (8.4%)	2106 (9%)	825 (3.4%)	574 (2.3%)
	BN	850 (7.1%)	363 (3%)	1106 (9.4%)	620 (5.3%)	346 (2.8%)	754 (6.5%)
	D	-104 (-1.2%)	-159 (-1.8%)	-187 (-2.1%)	-242 (-2.7%)	58 (0.7%)	-2 (0%)
	C	-72 (-1.1%)	-234 (-3.5%)	-116 (-1.7%)	-278 (-4.2%)	123 (1.9%)	-13 (-0.2%)
	All	1193 (6.6%)	1302 (7.2%)	1304 (7.3%)	1413 (7.9%)	255 (1.3%)	220 (1.2%)
Mar	W	478 (1.9%)	1279 (5.1%)	447 (1.8%)	1248 (5%)	8 (0%)	72 (0.3%)
	AN	154 (0.9%)	-190 (-1.1%)	809 (5.1%)	465 (2.9%)	530 (3.3%)	-20 (-0.1%)
	BN	-735 (-7.9%)	-931 (-10%)	-327 (-3.7%)	-523 (-5.9%)	160 (1.9%)	-72 (-0.8%)
	D	-125 (-1.5%)	-147 (-1.8%)	-132 (-1.6%)	-154 (-1.8%)	-89 (-1.1%)	-62 (-0.7%)
	C	324 (5.4%)	363 (6.1%)	148 (2.4%)	187 (3%)	197 (3.2%)	261 (4.3%)
	All	68 (0.5%)	240 (1.6%)	197 (1.4%)	368 (2.5%)	117 (0.8%)	32 (0.2%)
Apr	W	-106 (-0.7%)	-453 (-3%)	-125 (-0.8%)	-471 (-3.1%)	-12 (-0.1%)	-123 (-0.8%)
	AN	-387 (-3.7%)	-426 (-4.1%)	-333 (-3.2%)	-372 (-3.6%)	107 (1.1%)	290 (3%)
	BN	-411 (-4.7%)	-22 (-0.3%)	-197 (-2.3%)	193 (2.3%)	61 (0.7%)	406 (4.9%)
	D	-159 (-2%)	-46 (-0.6%)	26 (0.3%)	139 (1.8%)	135 (1.8%)	241 (3.1%)
	C	-142 (-1.8%)	34 (0.4%)	-11 (-0.1%)	166 (2.2%)	-28 (-0.4%)	-53 (-0.7%)
	All	-216 (-2%)	-215 (-2%)	-118 (-1.1%)	-116 (-1.1%)	48 (0.5%)	118 (1.1%)
May	W	-1308 (-10.4%)	-2077 (-16.6%)	-1272 (-10.2%)	-2040 (-16.3%)	8 (0.1%)	391 (3.9%)
	AN	490 (4.9%)	1218 (12.2%)	485 (4.8%)	1214 (12.1%)	879 (9.1%)	1184 (11.8%)
	BN	-358 (-4.1%)	-13 (-0.1%)	-157 (-1.8%)	188 (2.2%)	393 (4.9%)	893 (11.3%)
	D	164 (1.9%)	1258 (14.5%)	301 (3.5%)	1395 (16.3%)	417 (4.9%)	923 (10.2%)
	C	229 (3%)	787 (10.2%)	254 (3.3%)	812 (10.5%)	19 (0.2%)	185 (2.2%)
	All	-335 (-3.4%)	-91 (-0.9%)	-256 (-2.6%)	-12 (-0.1%)	293 (3.1%)	679 (7.4%)
Jun	W	-56 (-0.5%)	775 (6.5%)	-152 (-1.3%)	679 (5.7%)	259 (2.2%)	961 (8.2%)
	AN	881 (7.3%)	2357 (19.6%)	657 (5.4%)	2133 (17.4%)	655 (5.4%)	1568 (12.3%)
	BN	524 (4.6%)	942 (8.2%)	492 (4.3%)	911 (7.9%)	684 (6.1%)	756 (6.5%)
	D	922 (7.8%)	1406 (11.9%)	865 (7.3%)	1349 (11.4%)	671 (5.6%)	742 (6%)
	C	864 (7.9%)	1052 (9.7%)	626 (5.6%)	814 (7.3%)	210 (1.8%)	56 (0.5%)
	All	529 (4.5%)	1214 (10.4%)	413 (3.5%)	1098 (9.3%)	473 (4%)	834 (6.9%)
Jul	W	903 (6.8%)	1396 (10.5%)	739 (5.5%)	1233 (9.2%)	221 (1.6%)	126 (0.9%)
	AN	532 (3.8%)	846 (6%)	281 (2%)	595 (4.1%)	67 (0.5%)	-166 (-1.1%)
	BN	729 (5.6%)	87 (0.7%)	651 (5%)	8 (0.1%)	468 (3.5%)	-160 (-1.2%)
	D	369 (2.8%)	-509 (-3.8%)	197 (1.5%)	-681 (-5%)	-3 (0%)	-967 (-7%)
	C	-373 (-2.9%)	-1153 (-8.9%)	-139 (-1.1%)	-919 (-7.2%)	288 (2.3%)	-298 (-2.5%)
	All	515 (3.9%)	301 (2.3%)	409 (3%)	195 (1.5%)	201 (1.5%)	-268 (-1.9%)

Month	Water-Year Type[a]	Scenarios[b]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Aug	W	-511 (-4.5%)	-594 (-5.3%)	-488 (-4.3%)	-572 (-5.1%)	73 (0.7%)	-46 (-0.4%)
	AN	715 (6.8%)	843 (8%)	471 (4.4%)	599 (5.5%)	327 (3%)	-351 (-3%)
	BN	643 (6.3%)	75 (0.7%)	560 (5.4%)	-8 (-0.1%)	873 (8.8%)	-87 (-0.8%)
	D	-1223 (-11.4%)	-1165 (-10.8%)	-1390 (-12.7%)	-1332 (-12.2%)	-1086 (-10.2%)	-1561 (-14%)
	C	-1264 (-13.2%)	-2463 (-25.7%)	-1330 (-13.8%)	-2528 (-26.2%)	-306 (-3.5%)	-537 (-7%)
	All	-401 (-3.8%)	-668 (-6.3%)	-490 (-4.6%)	-757 (-7.1%)	-63 (-0.6%)	-502 (-4.8%)
Sep	W	2346 (23.8%)	3818 (38.7%)	-641 (-5%)	830 (6.5%)	-292 (-2.3%)	361 (2.7%)
	AN	1976 (31.5%)	3460 (55.1%)	-351 (-4.1%)	1133 (13.2%)	-1379 (-14.3%)	-581 (-5.6%)
	BN	-311 (-5.3%)	-620 (-10.6%)	-315 (-5.4%)	-623 (-10.7%)	-528 (-8.7%)	-762 (-12.8%)
	D	-1400 (-21.9%)	-886 (-13.9%)	-1107 (-18.2%)	-594 (-9.7%)	-433 (-8%)	594 (12.1%)
	C	-774 (-13.2%)	-160 (-2.7%)	-532 (-9.4%)	82 (1.5%)	-166 (-3.2%)	889 (18.4%)
	All	559 (7.7%)	1393 (19.1%)	-629 (-7.4%)	204 (2.4%)	-504 (-6%)	160 (1.9%)
Oct	W	-434 (-5.4%)	28 (0.4%)	-101 (-1.3%)	362 (4.7%)	-77 (-1%)	-140 (-1.7%)
	AN	-1339 (-16.5%)	145 (1.8%)	-533 (-7.3%)	951 (13%)	-335 (-4.7%)	95 (1.2%)
	BN	-718 (-10.1%)	52 (0.7%)	-662 (-9.4%)	108 (1.5%)	-168 (-2.6%)	-632 (-8.1%)
	D	-255 (-3.7%)	204 (3%)	-69 (-1%)	391 (5.8%)	-42 (-0.6%)	-180 (-2.5%)
	C	-719 (-10.8%)	-259 (-3.9%)	-469 (-7.3%)	-9 (-0.1%)	-302 (-4.8%)	-126 (-1.9%)
	All	-618 (-8.3%)	46 (0.6%)	-307 (-4.3%)	357 (5%)	-156 (-2.2%)	-196 (-2.6%)
Nov	W	-37 (-0.4%)	-223 (-2.3%)	-1192 (-10.8%)	-1378 (-12.5%)	-1127 (-10.3%)	-1168 (-10.8%)
	AN	-419 (-5.1%)	-714 (-8.8%)	-1194 (-13.4%)	-1488 (-16.7%)	-1637 (-17.5%)	-1668 (-18.3%)
	BN	-452 (-6.7%)	-194 (-2.9%)	-1227 (-16.2%)	-968 (-12.8%)	-1372 (-17.8%)	-1085 (-14.1%)
	D	-947 (-12.5%)	-1068 (-14.2%)	-768 (-10.4%)	-890 (-12.1%)	-820 (-11%)	-867 (-11.8%)
	C	-356 (-6.1%)	-395 (-6.8%)	-450 (-7.6%)	-489 (-8.3%)	-350 (-6%)	-287 (-5%)
	All	-410 (-5.1%)	-501 (-6.3%)	-997 (-11.6%)	-1087 (-12.7%)	-1062 (-12.3%)	-1032 (-12.1%)
Dec	W	698 (3.3%)	-1546 (-7.4%)	1978 (10%)	-267 (-1.4%)	159 (0.7%)	-144 (-0.7%)
	AN	2 (0%)	141 (1.4%)	-9 (-0.1%)	131 (1.3%)	-348 (-3.4%)	107 (1.1%)
	BN	333 (4%)	133 (1.6%)	506 (6.1%)	306 (3.7%)	-180 (-2%)	313 (3.8%)
	D	-246 (-3.4%)	-155 (-2.1%)	-7 (-0.1%)	84 (1.2%)	1 (0%)	45 (0.6%)
	C	-46 (-0.8%)	-148 (-2.6%)	188 (3.5%)	86 (1.6%)	117 (2.1%)	47 (0.9%)
	All	218 (1.8%)	-503 (-4.2%)	738 (6.4%)	18 (0.2%)	-14 (-0.1%)	40 (0.4%)

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

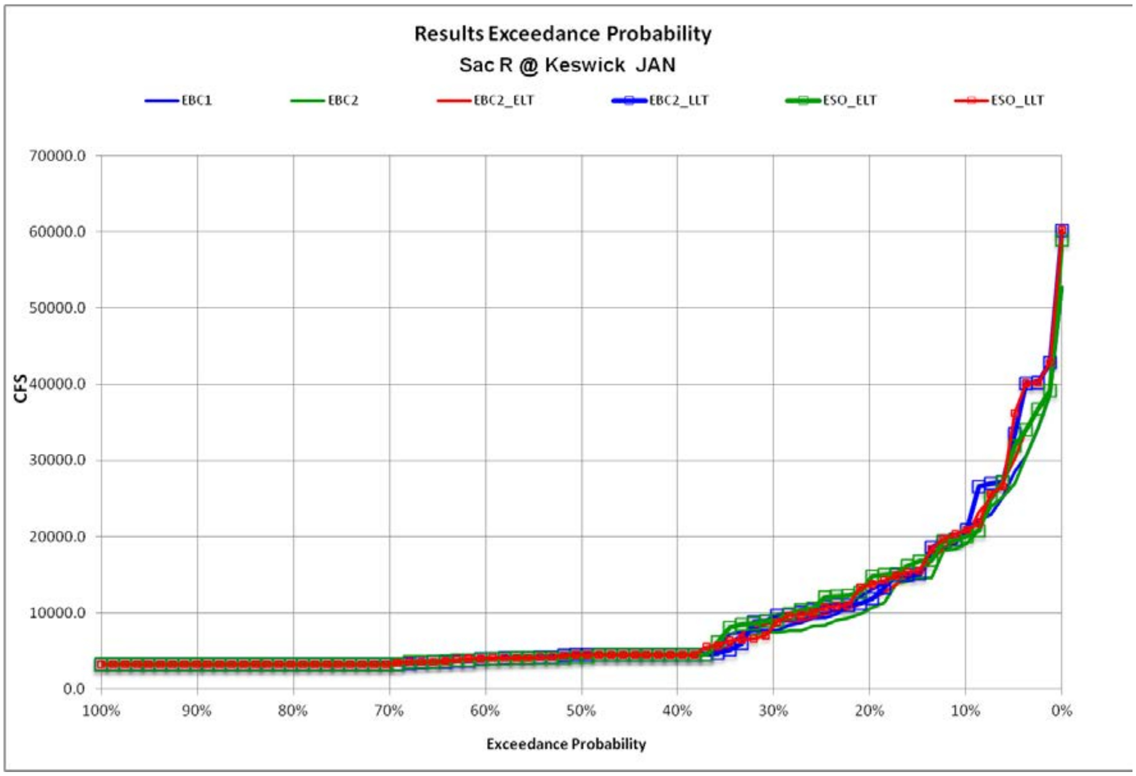


Figure 5C.5.2-1. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Keswick, January

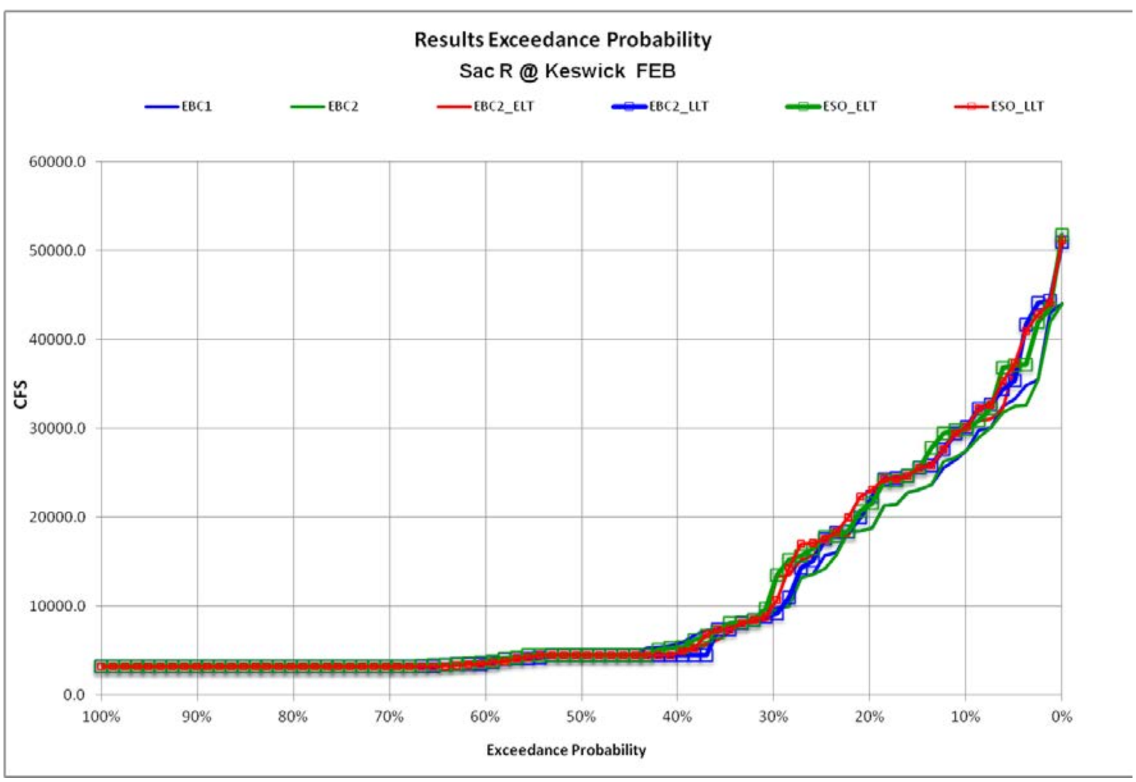


Figure 5C.5.2-2. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Keswick, February

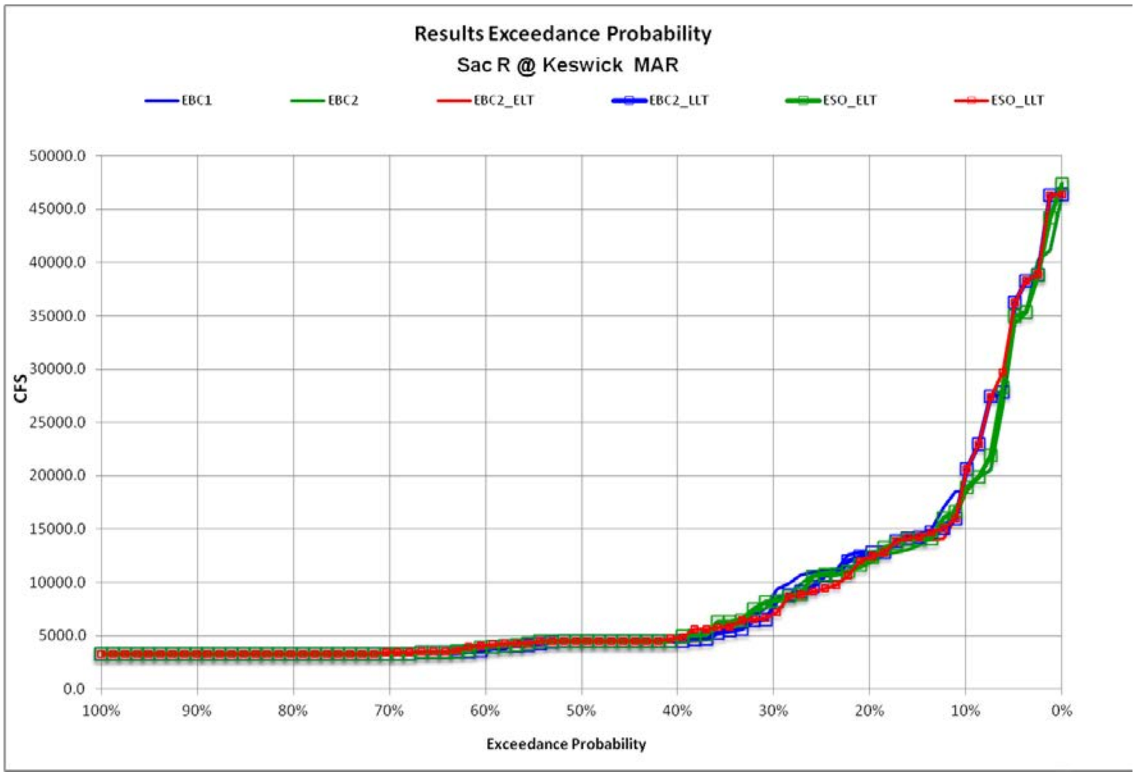


Figure 5C.5.2-3. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Keswick, March

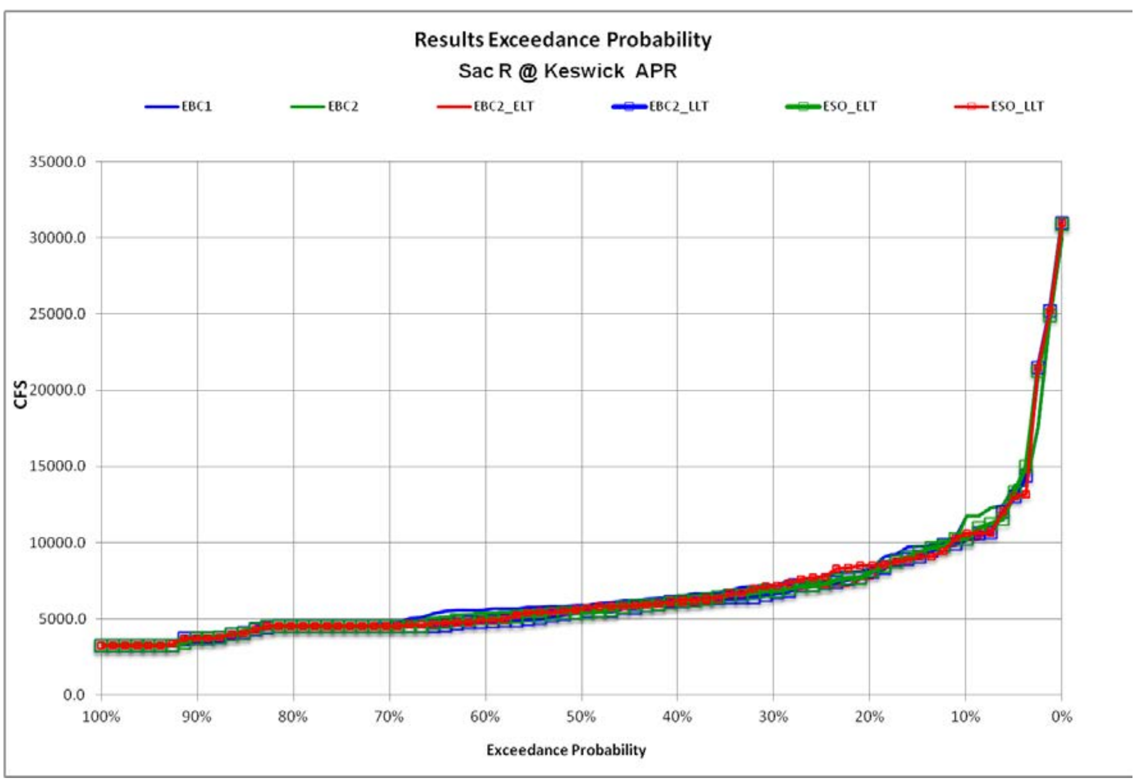


Figure 5C.5.2-4. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Keswick, April

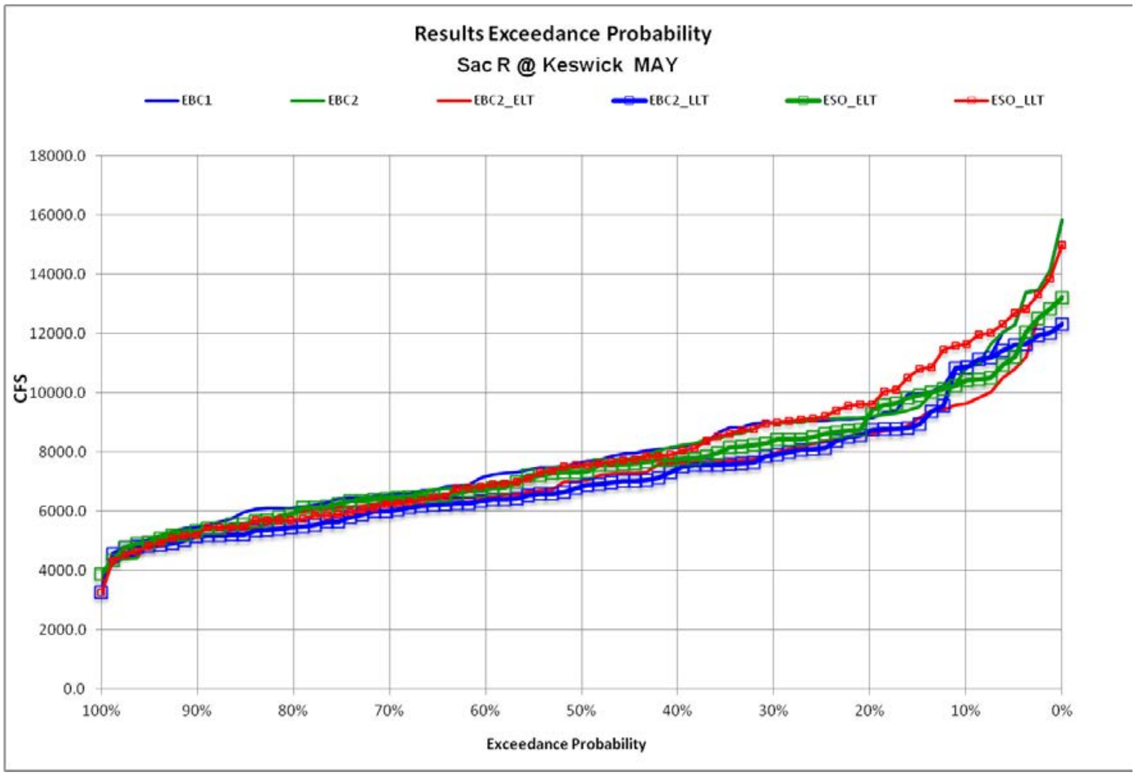


Figure 5C.5.2-5. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Keswick, May

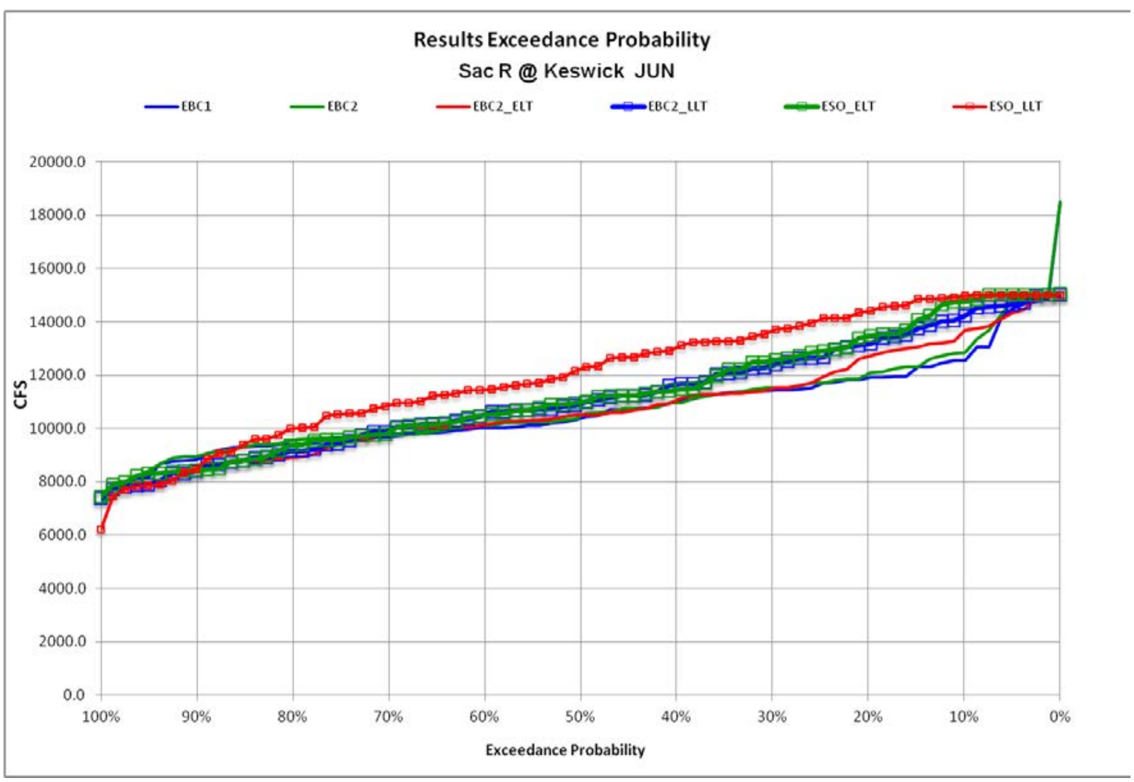


Figure 5C.5.2-6. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Keswick, June

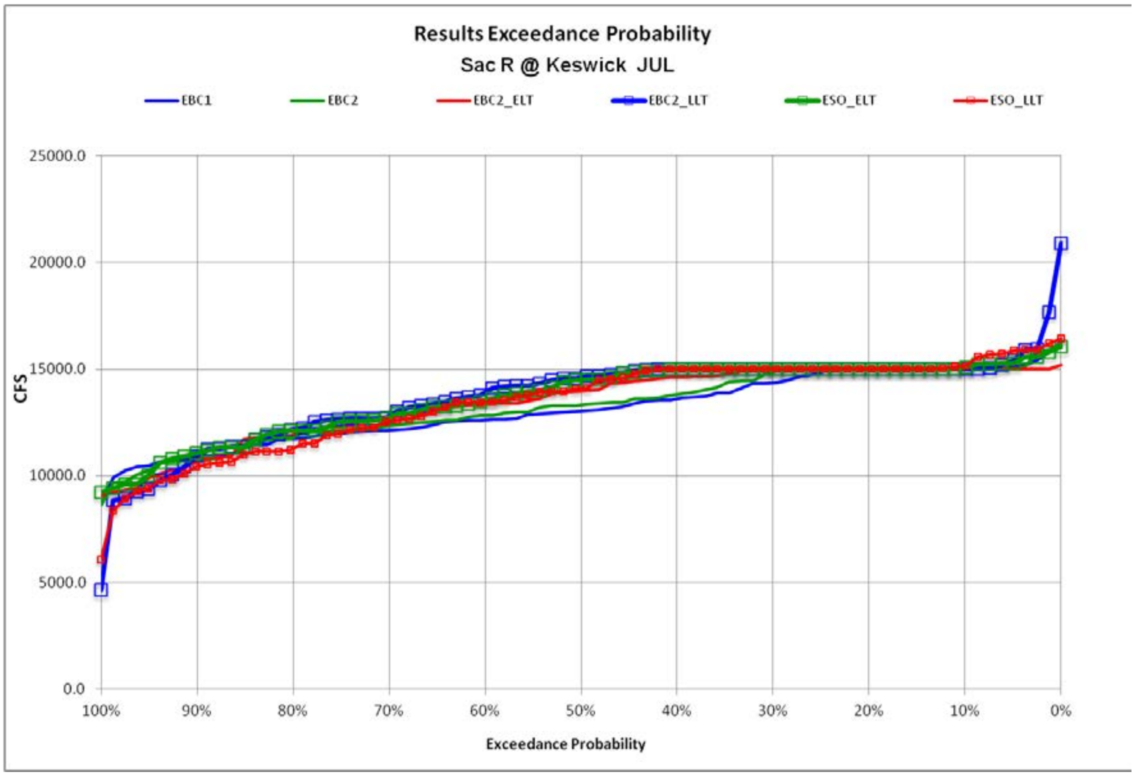


Figure 5C.5.2-7. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Keswick, July

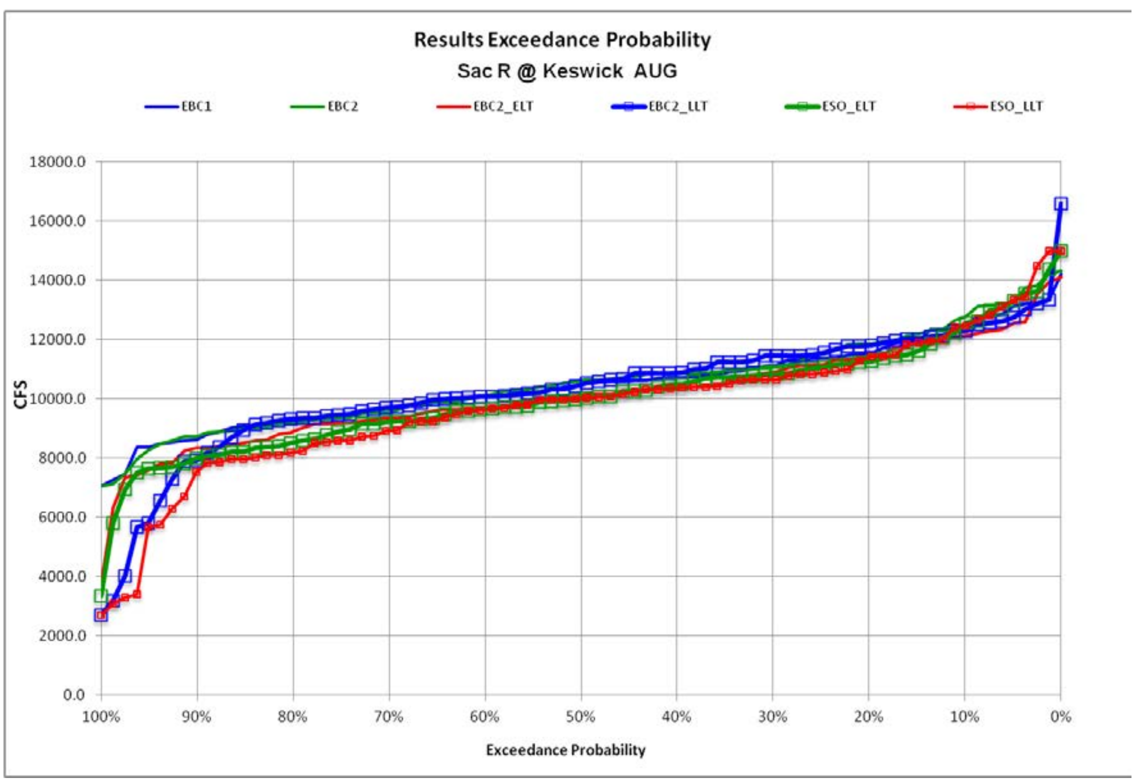


Figure 5C.5.2-8. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Keswick, August

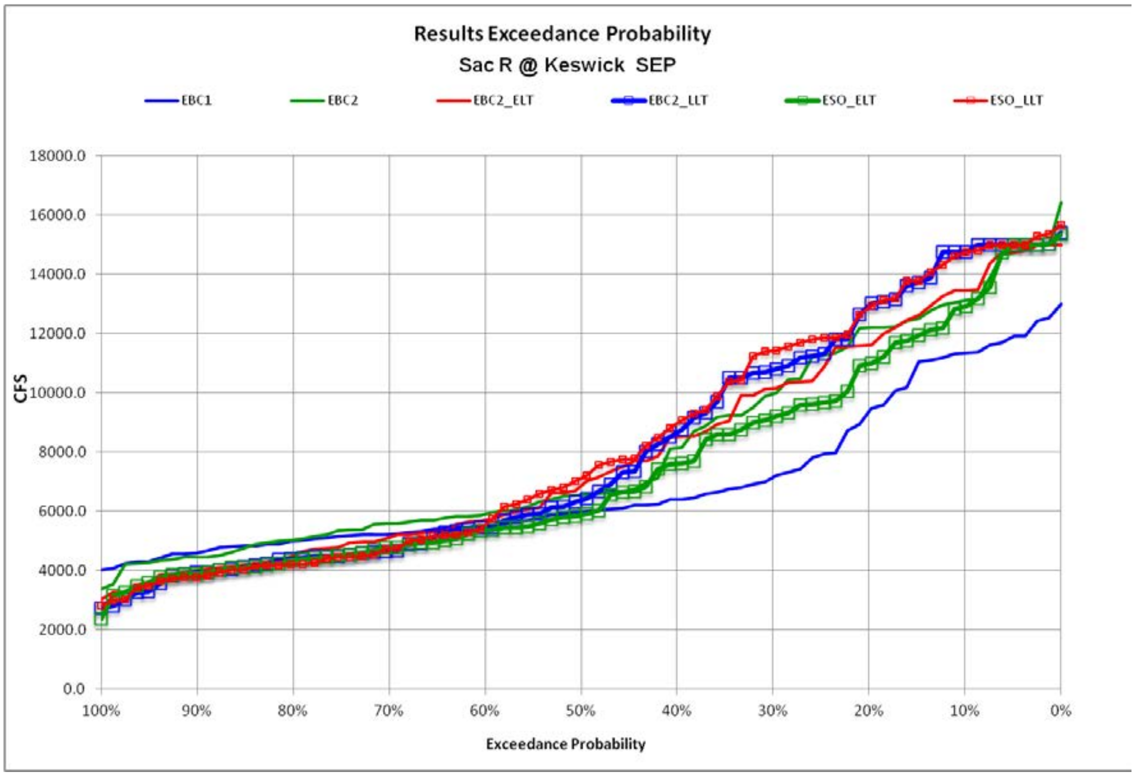


Figure 5C.5.2-9. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Keswick, September

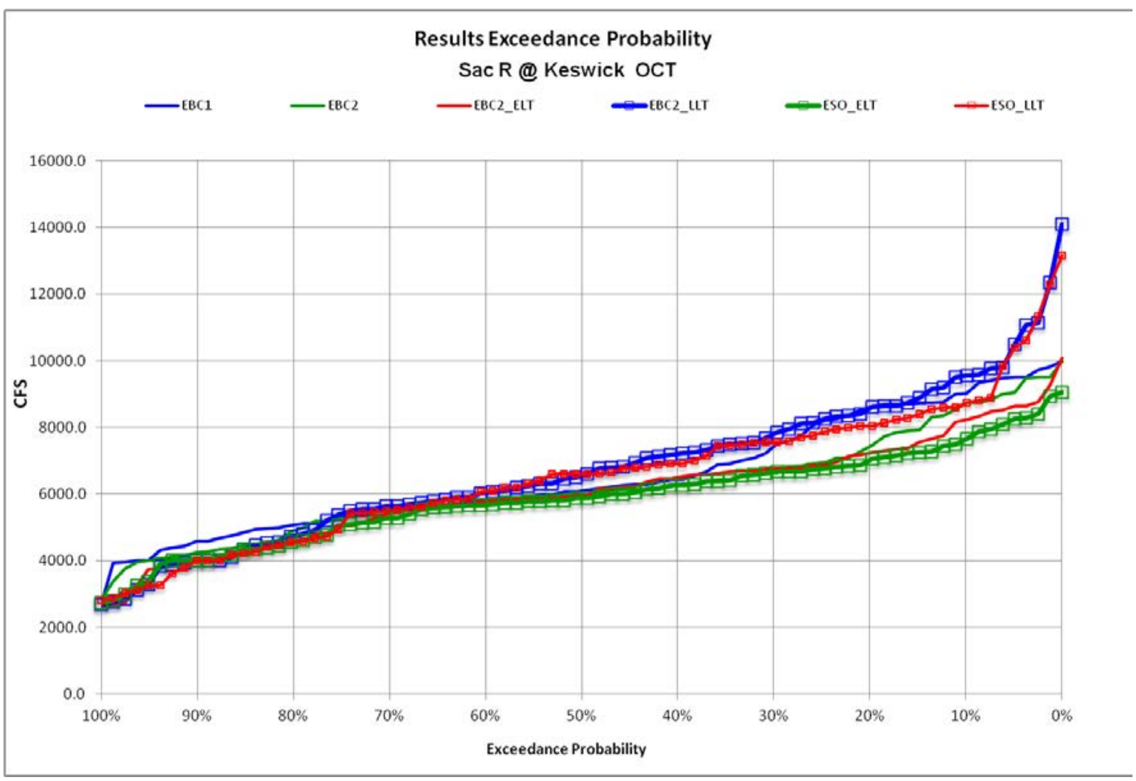


Figure 5C.5.2-10. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Keswick, October

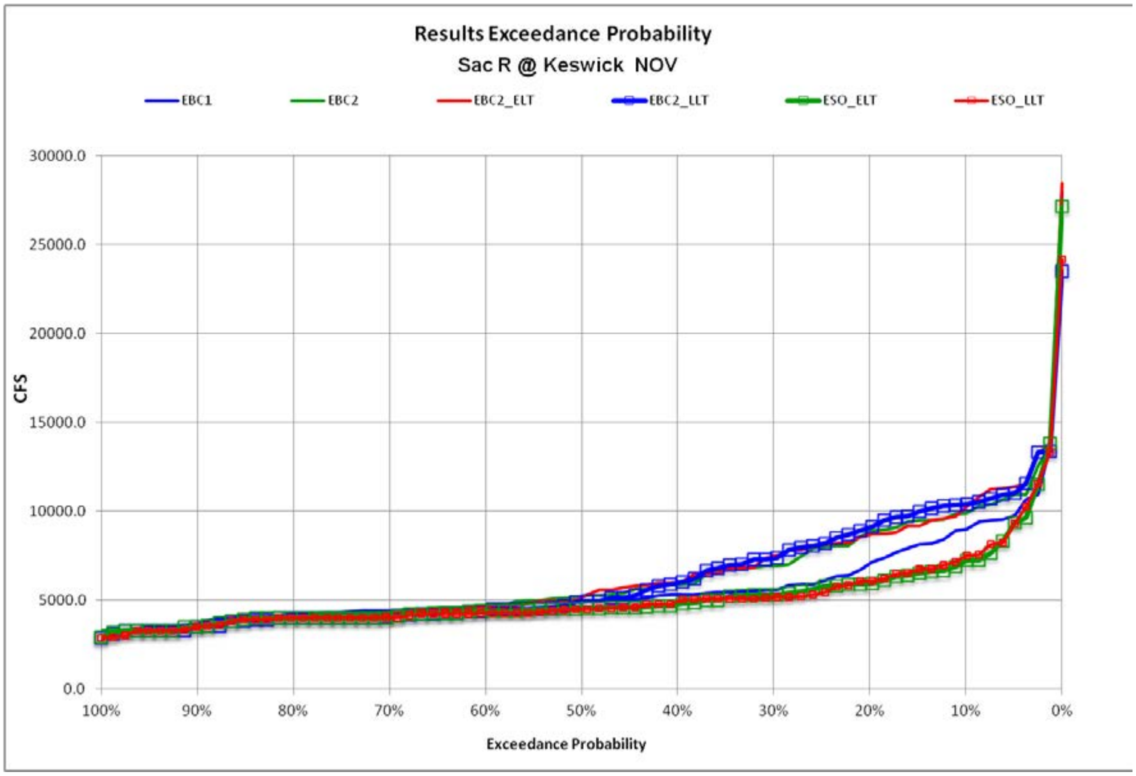


Figure 5C.5.2-11. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Keswick, November

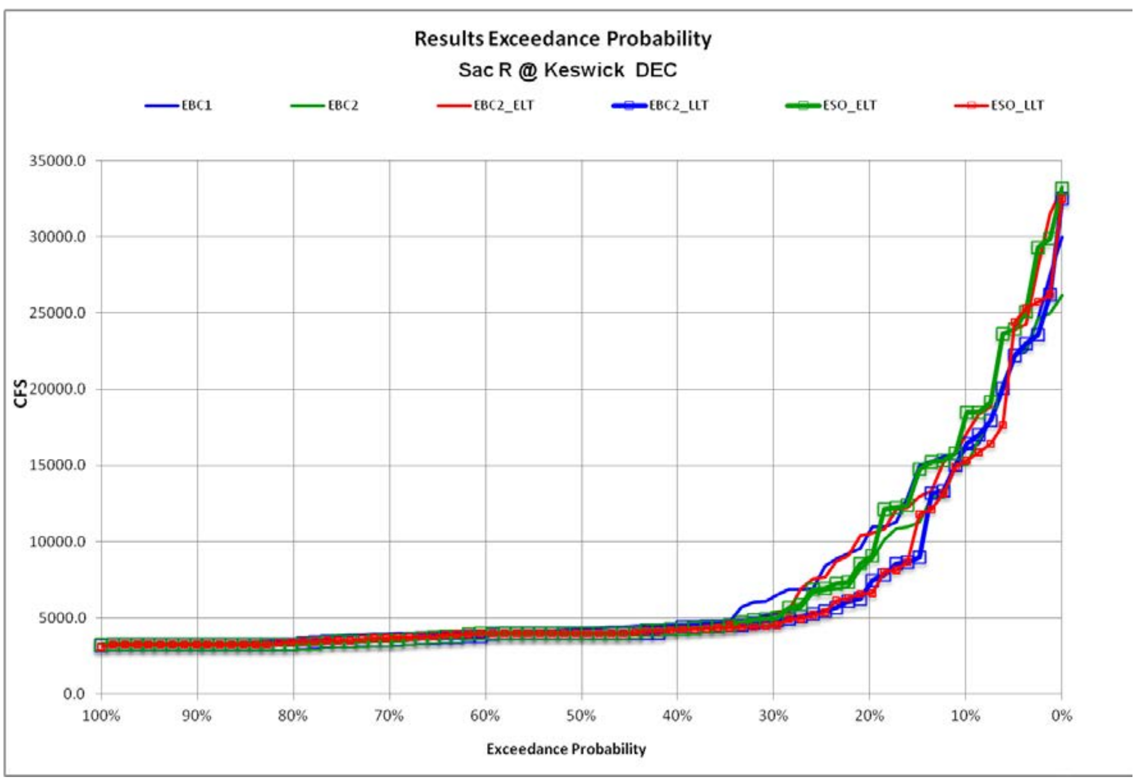


Figure 5C.5.2-12. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Keswick, December

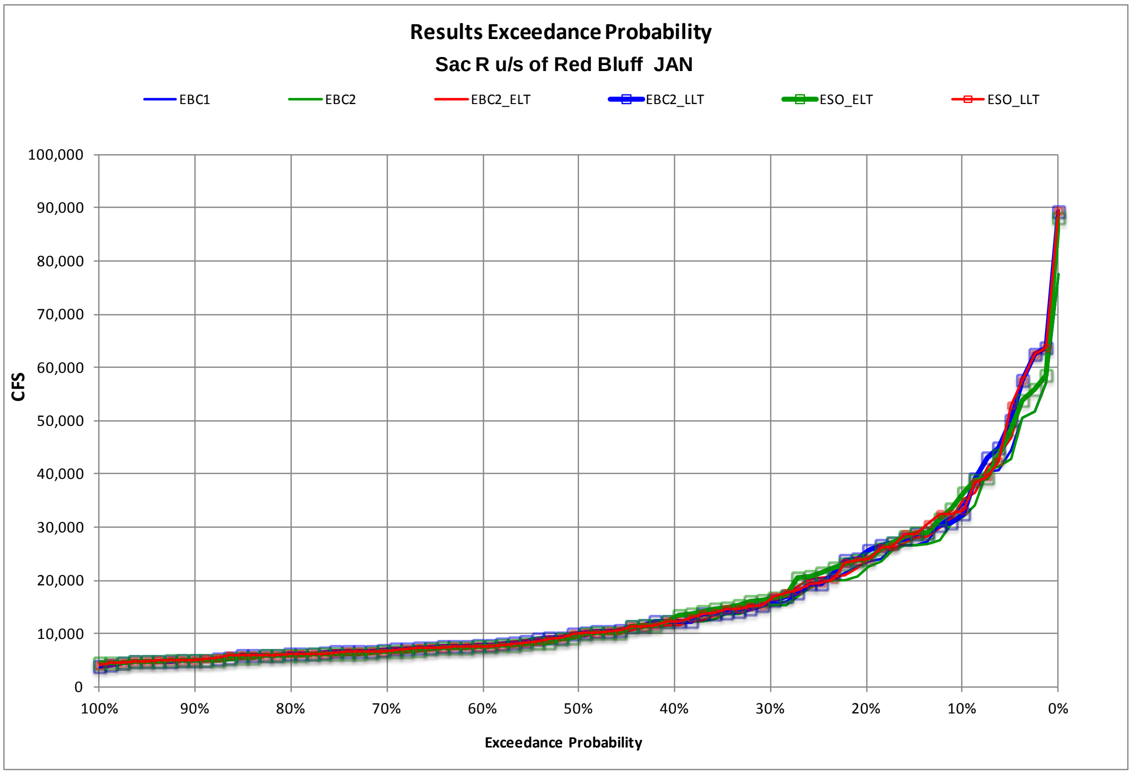


Figure 5C.5.2-13. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River upstream of Red Bluff Diversion Dam, January

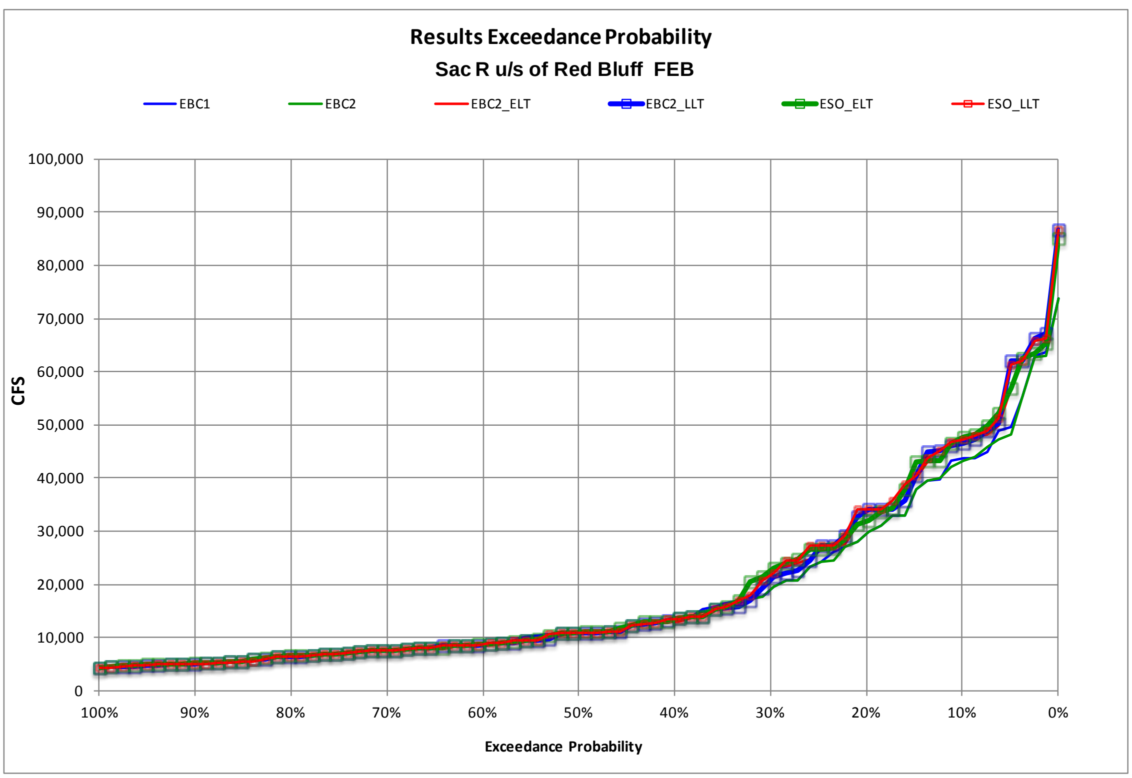


Figure 5C.5.2-14. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River upstream of Red Bluff Diversion Dam, February

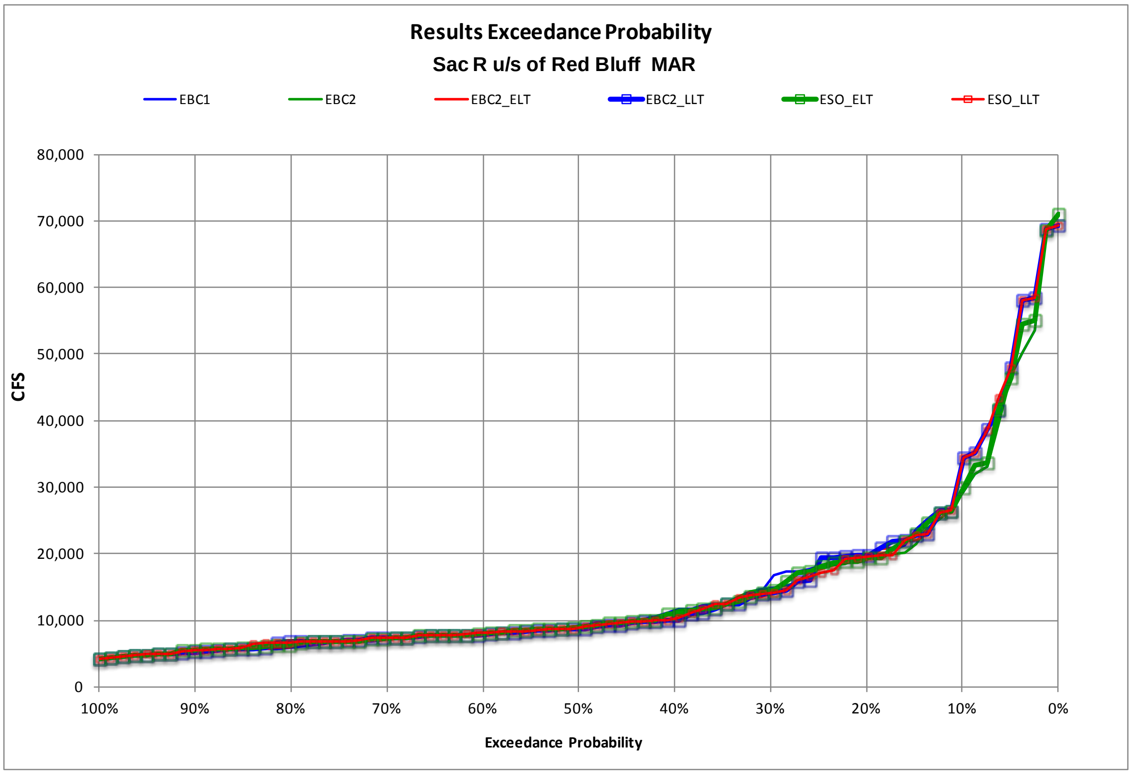


Figure 5C.5.2-15. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River upstream of Red Bluff Diversion Dam, March

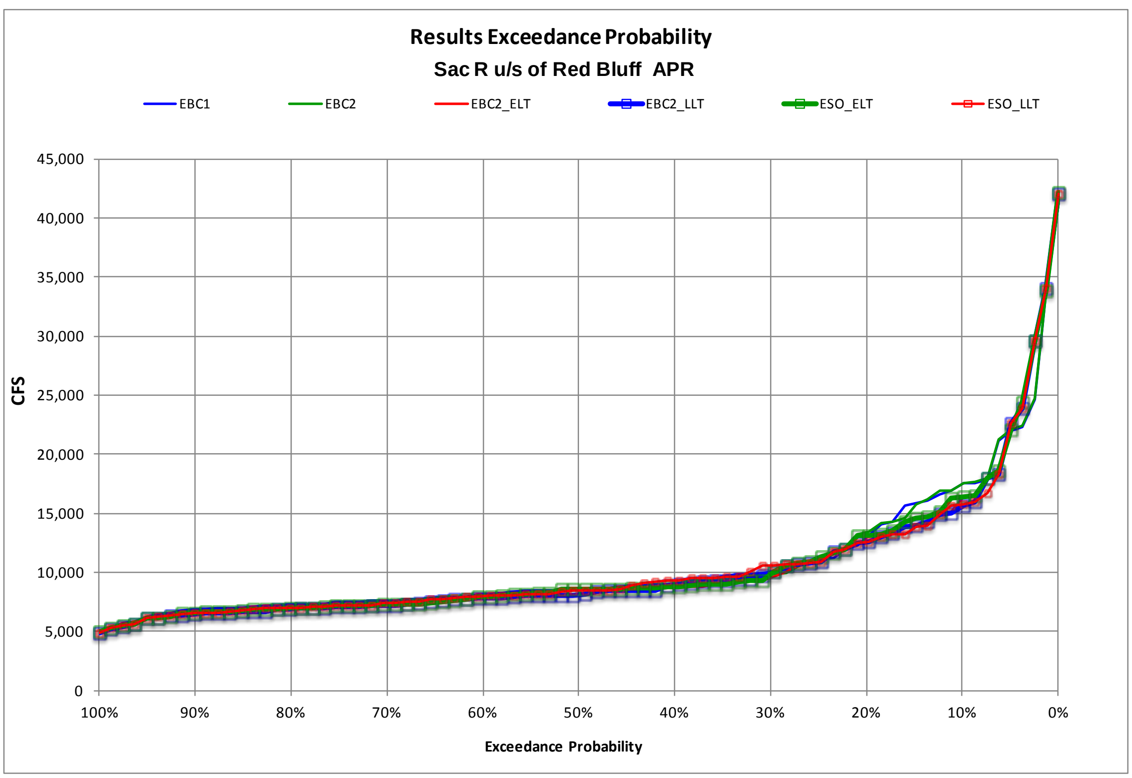


Figure 5C.5.2-16. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River upstream of Red Bluff Diversion Dam, April

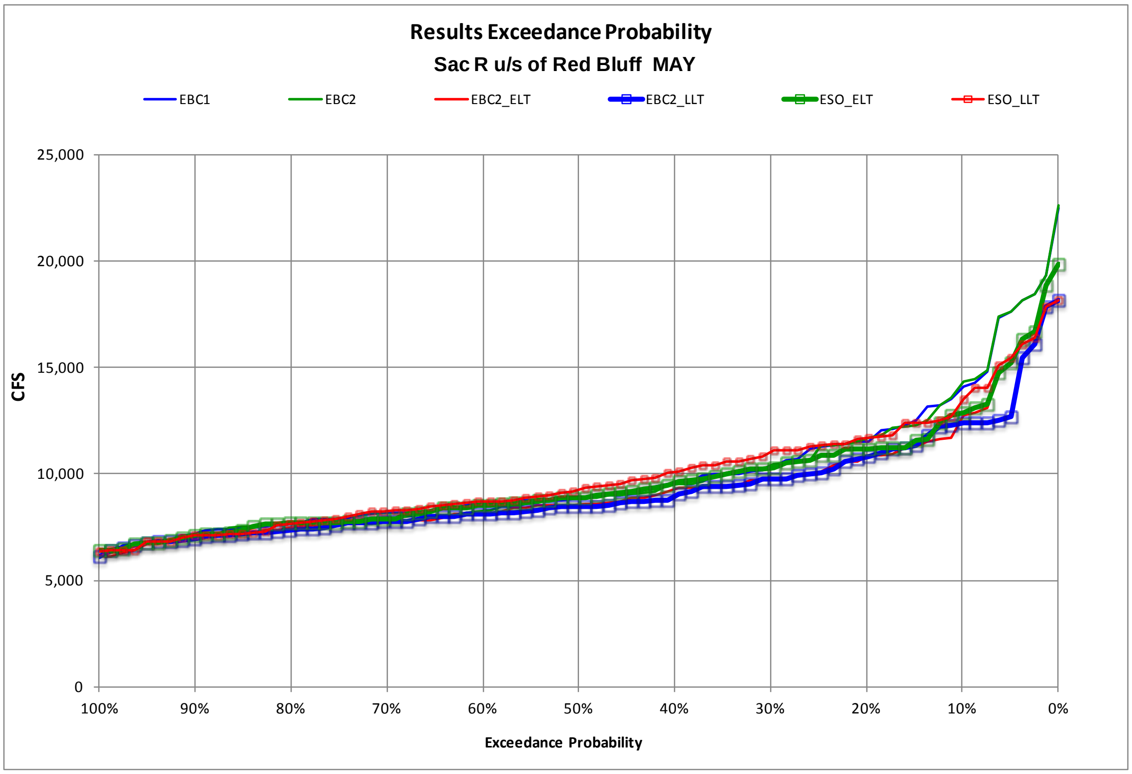


Figure 5C.5.2-17. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River upstream of Red Bluff Diversion Dam, May

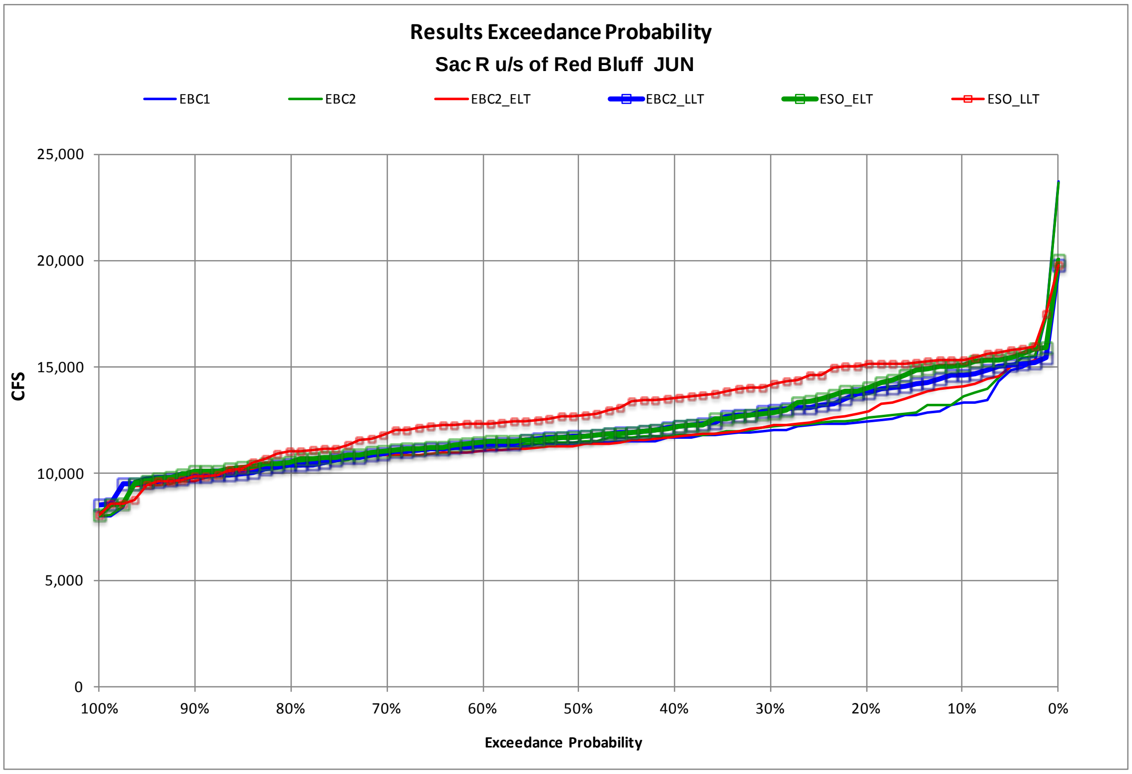


Figure 5C.5.2-18. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River upstream of Red Bluff Diversion Dam, June

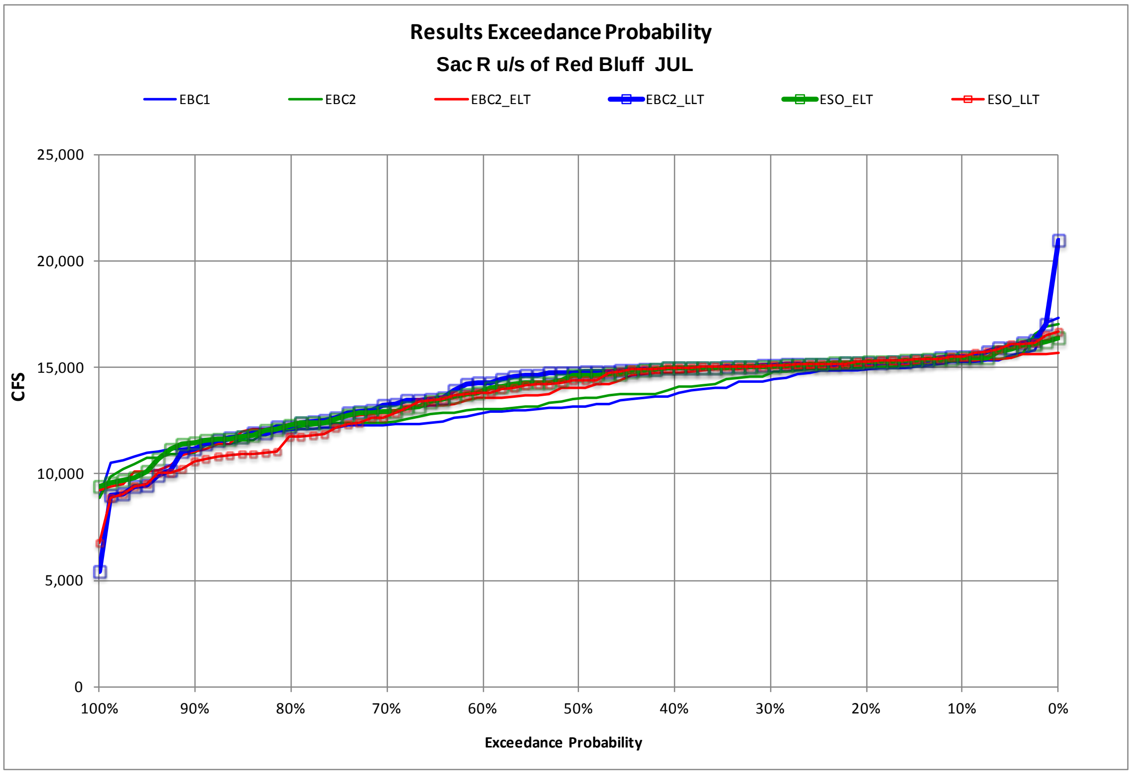


Figure 5C.5.2-19. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River upstream of Red Bluff Diversion Dam, July

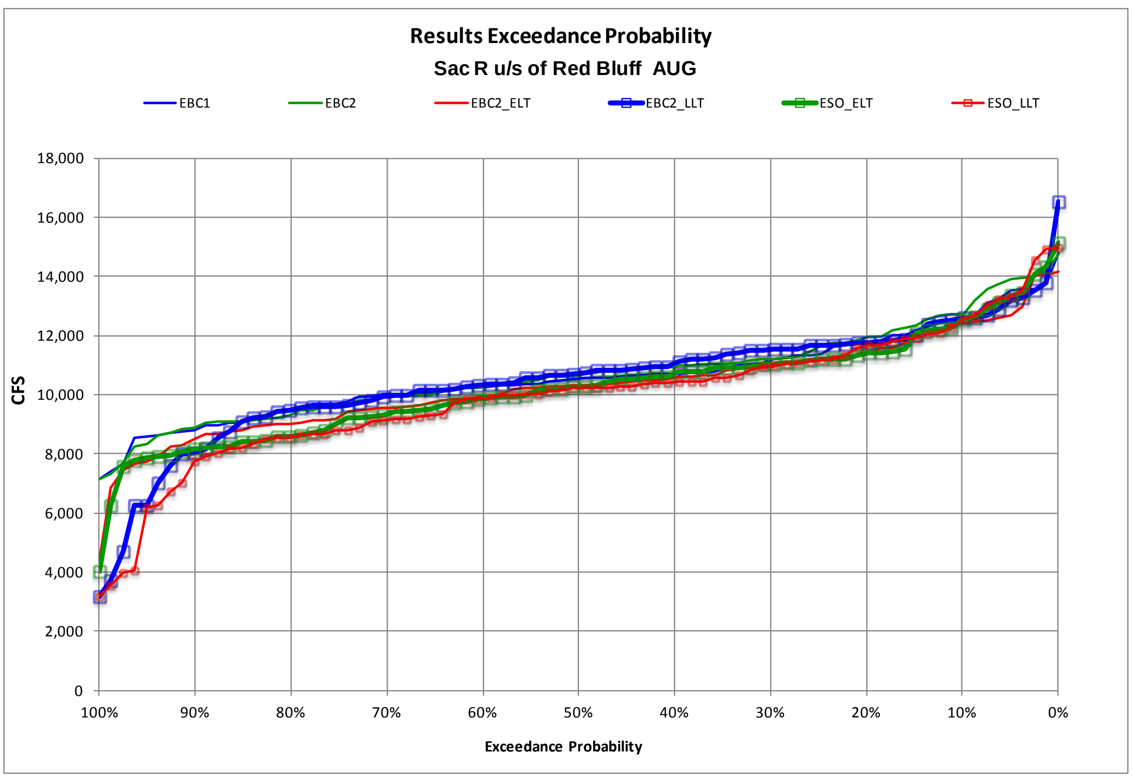


Figure 5C.5.2-20. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River upstream of Red Bluff Diversion Dam, August

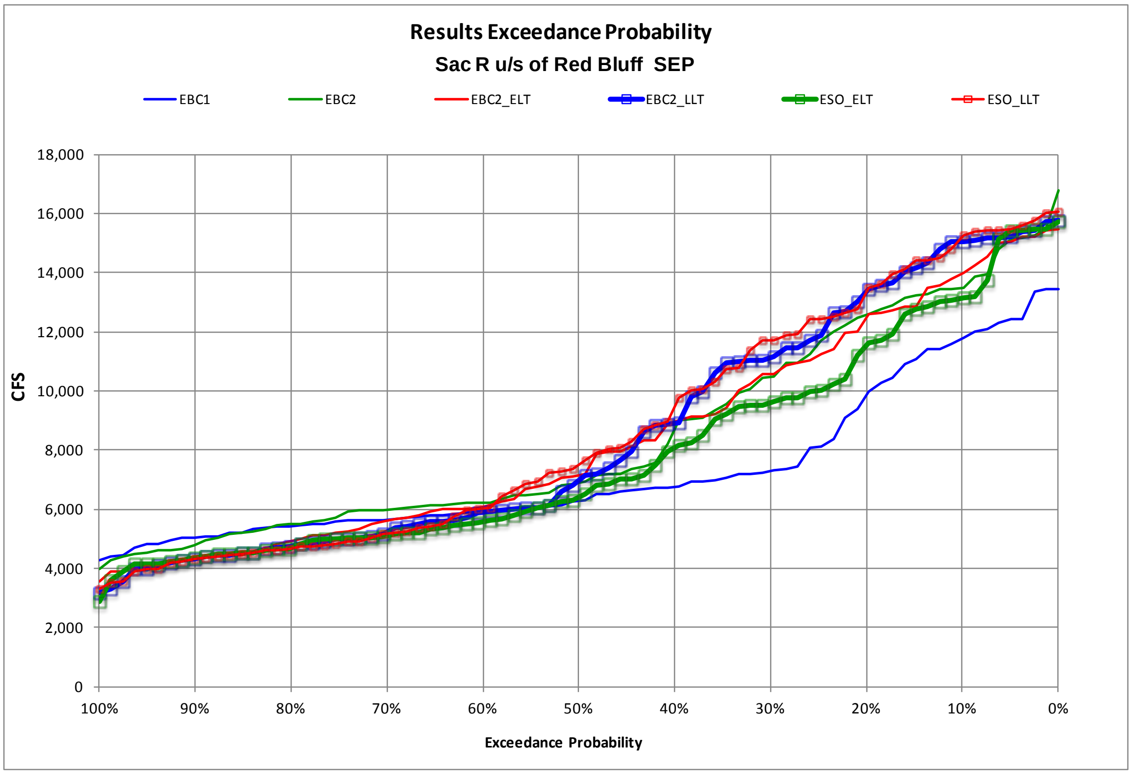


Figure 5C.5.2-21. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River upstream of Red Bluff Diversion Dam, September

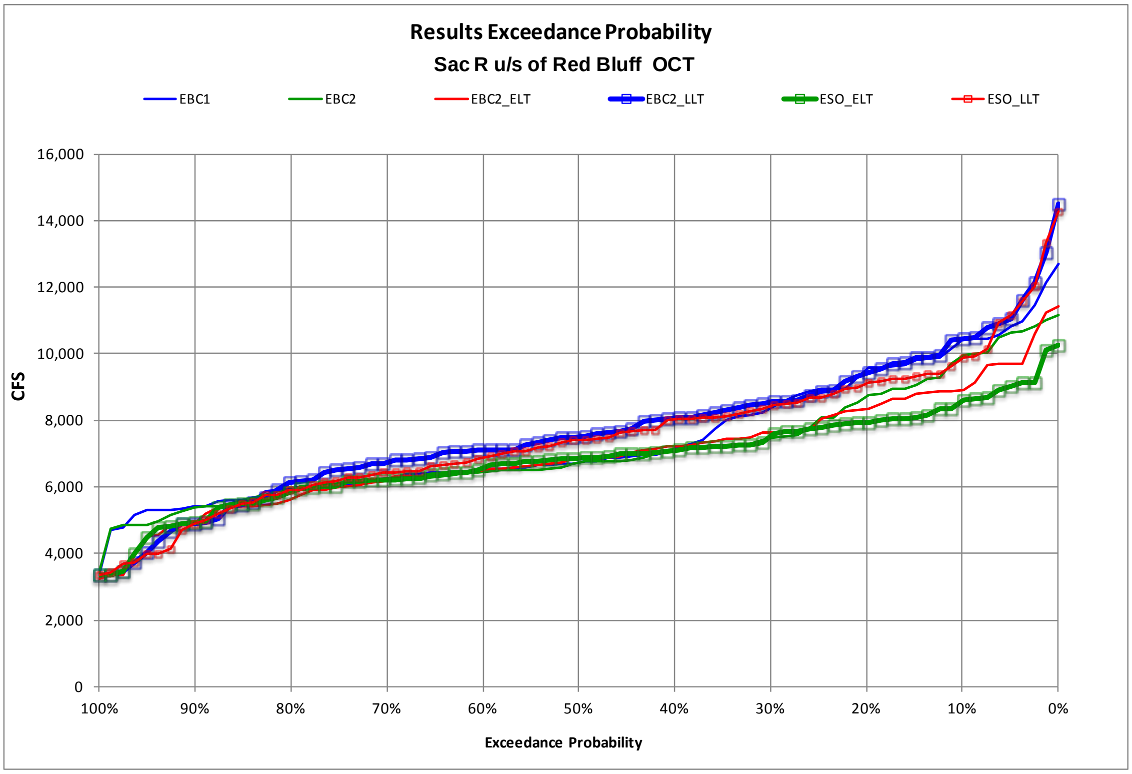


Figure 5C.5.2-22. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River upstream of Red Bluff Diversion Dam, October

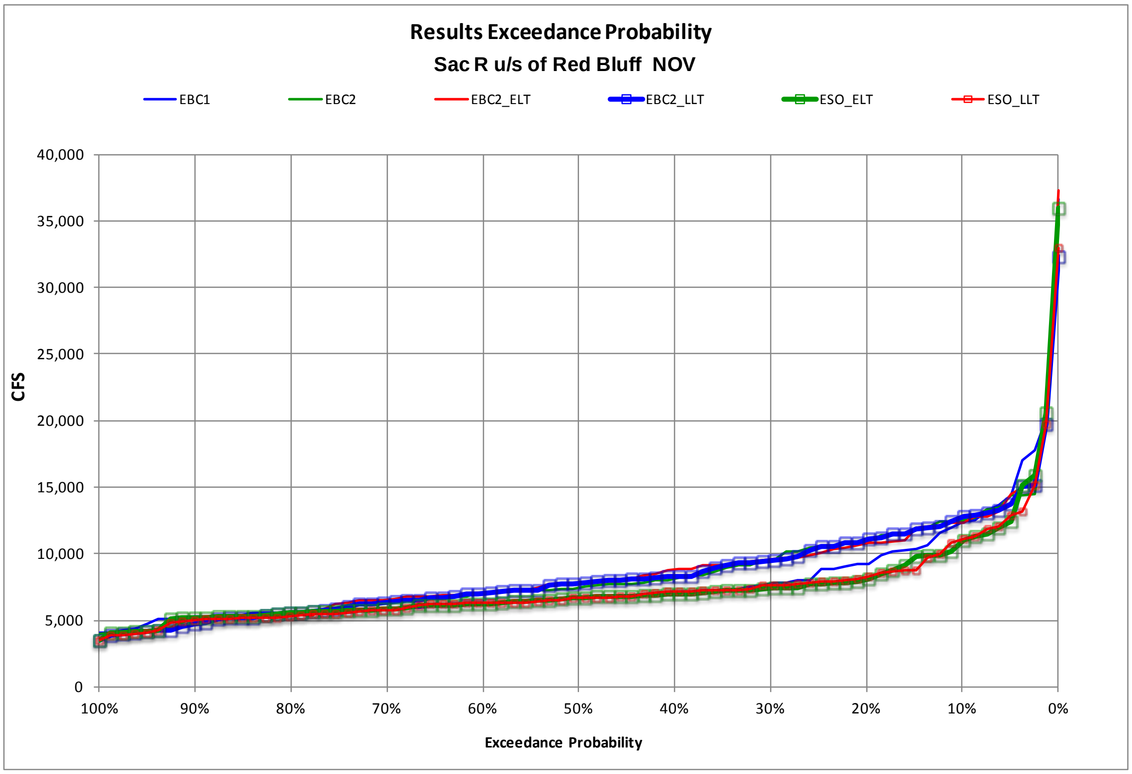


Figure 5C.5.2-23. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River upstream of Red Bluff Diversion Dam, November

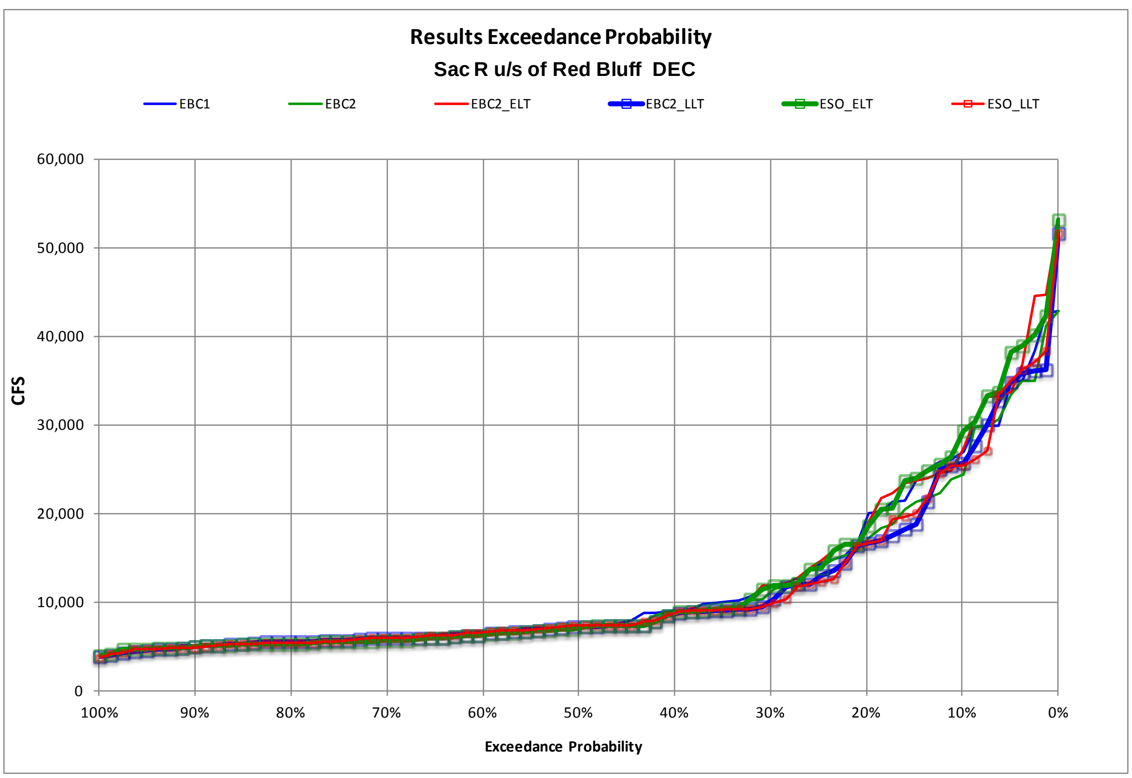


Figure 5C.5.2-24. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River upstream of Red Bluff Diversion Dam, December

The range of flows under the high outflow scenario (HOS) and low outflow scenario (LOS) in the Sacramento River at Keswick and upstream of the RBDD are presented in Table 5C.5.2-5 and Table 5C.5.2-7, respectively, and differences from the ESO are presented in Table 5C.5.2-6 and Table 5C.5.2-8. December through June flows under HOS and LOS at both locations would generally be similar to or greater than those under the ESO. One exception during this period is June at both Sacramento River locations in which average flows under HOS are up to 7% lower than flows under ESO in both the ELT and LLT. However, flows under HOS at both locations would be similar to (<5% different) flows under EBC2_LLT, indicating that there would be no effects of these reduced flows under HOS_LLT on steelhead spawning and egg incubation. Therefore, similar to the ESO, effects of the HOS and LOS on Sacramento River flows during the steelhead spawning and egg incubation period would be small. As a result, no further biological analyses related to flow effects on steelhead spawning and egg incubation in the Sacramento River were conducted for HOS and LOS.

Table 5C.5.2-5. Mean Monthly Flows (cfs) in the Sacramento River at Keswick for ESO, HOS, and LOS Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	17,764	18,545	17,668	18,577	18,118	19,502
	AN	8,471	7,795	8,367	7,694	8,885	9,589
	BN	4,918	4,342	4,697	4,543	4,858	5,129
	D	4,098	3,803	4,096	3,763	4,236	4,043
	C	3,516	4,364	3,509	3,506	4,163	4,780
	All	9,126	9,235	9,041	9,131	9,413	10,050
Feb	W	20,494	20,888	20,607	20,905	20,579	21,375
	AN	15,912	15,871	15,680	15,709	16,707	16,952
	BN	6,808	6,301	6,708	6,664	6,844	7,083
	D	3,506	3,407	3,324	3,447	3,367	3,415
	C	3,510	3,358	3,393	3,429	3,399	3,470
	All	11,272	11,261	11,200	11,323	11,375	11,725
Mar	W	16,408	17,139	16,408	17,135	16,430	17,171
	AN	9,205	8,803	8,963	8,541	9,299	9,319
	BN	4,472	4,252	4,380	4,171	4,851	4,896
	D	3,771	3,753	3,744	3,992	3,594	3,746
	C	3,802	3,842	3,639	3,708	3,781	3,940
	All	8,697	8,834	8,617	8,814	8,741	9,043
Apr	W	9,242	9,009	9,222	9,004	9,268	9,155
	AN	5,822	5,827	5,817	5,859	5,865	5,833
	BN	5,000	5,414	5,166	4,914	5,317	5,398
	D	5,633	5,776	5,462	5,502	5,662	5,774
	C	6,313	6,498	6,254	6,424	6,355	6,494
	All	6,797	6,852	6,772	6,699	6,877	6,896
May	W	8,191	7,541	8,161	7,296	8,187	7,589
	AN	8,189	8,971	7,892	8,723	8,198	8,750
	BN	6,810	7,169	6,441	6,383	7,238	7,383
	D	7,496	8,608	7,314	7,899	7,584	8,721
	C	6,920	7,499	6,973	7,359	7,189	7,505
	All	7,616	7,915	7,468	7,490	7,748	7,960

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jun	W	10,321	11,240	10,076	10,485	10,326	11,390
	AN	12,068	13,610	11,111	11,861	12,148	13,532
	BN	11,267	11,711	10,659	10,690	11,419	11,929
	D	12,141	12,648	11,482	11,842	11,988	12,667
	C	11,252	11,456	10,984	11,105	11,254	11,276
	All	11,274	12,008	10,769	11,110	11,280	12,059
Jul	W	13,698	14,230	13,541	14,242	13,728	14,332
	AN	14,615	14,940	14,651	14,730	14,609	15,088
	BN	13,673	13,020	13,224	12,840	13,357	13,090
	D	13,653	12,764	13,338	12,991	13,858	13,117
	C	12,471	11,605	11,804	11,837	12,287	11,346
	All	13,639	13,421	13,351	13,447	13,611	13,527
Aug	W	10,520	10,445	10,613	10,848	10,567	10,385
	AN	11,165	11,287	11,375	11,964	10,999	11,427
	BN	10,757	10,172	10,675	10,764	10,459	9,961
	D	9,380	9,420	10,827	10,657	9,418	9,485
	C	8,093	6,761	8,477	7,710	7,958	7,582
	All	10,049	9,757	10,470	10,496	9,978	9,857
Sep	W	11,720	13,194	12,006	13,550	7,981	7,110
	AN	7,834	9,315	8,951	10,153	6,835	6,205
	BN	5,156	4,836	5,069	5,521	5,991	5,516
	D	4,543	5,053	4,809	5,223	5,068	5,160
	C	4,717	5,239	4,791	5,251	5,034	5,187
	All	7,430	8,248	7,739	8,640	6,403	5,996
Oct	W	6,408	6,895	6,554	6,738	6,454	6,437
	AN	5,750	7,247	6,411	8,230	6,134	6,886
	BN	5,662	6,435	6,051	6,331	6,014	6,543
	D	5,862	6,326	6,038	6,788	5,818	6,663
	C	5,161	5,610	5,667	5,772	5,594	6,148
	All	5,882	6,555	6,204	6,756	6,066	6,528
Nov	W	6,493	6,369	6,397	6,500	6,169	5,788
	AN	5,716	5,469	6,092	6,115	5,071	4,559
	BN	4,553	4,845	4,774	4,679	4,339	4,178
	D	4,627	4,535	4,574	4,598	4,663	4,256
	C	4,437	4,413	4,246	4,246	4,309	4,294
	All	5,337	5,288	5,360	5,385	5,093	4,778
Dec	W	12,958	10,870	13,066	11,173	13,933	12,552
	AN	5,370	5,472	5,557	5,318	5,279	5,453
	BN	5,667	5,500	5,802	5,250	5,621	5,712
	D	3,877	3,973	3,755	3,728	4,341	4,314
	C	3,703	3,613	3,548	3,584	3,759	3,777
	All	7,255	6,587	7,290	6,560	7,653	7,253

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-6. Differences between ESO Scenarios and HOS and LOS Scenarios in Mean Monthly Flows (cfs) in the Sacramento River at Keswick

Month	Water-Year Type[a]	Scenarios[b]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	-96 (-0.5%)	33 (0.2%)	354 (2%)	957 (5.2%)
	AN	-104 (-1.2%)	-101 (-1.3%)	414 (4.9%)	1794 (23%)
	BN	-220 (-4.5%)	201 (4.6%)	-59 (-1.2%)	787 (18.1%)
	D	-2 (-0.05%)	-40 (-1%)	138 (3.4%)	240 (6.3%)
	C	-7 (-0.2%)	-858 (-19.7%)	647 (18.4%)	416 (9.5%)
	All	-85 (-0.9%)	-104 (-1.1%)	287 (3.2%)	814 (8.8%)
Feb	W	113 (0.5%)	17 (0.1%)	85 (0.4%)	487 (2.3%)
	AN	-232 (-1.5%)	-162 (-1%)	795 (5%)	1081 (6.8%)
	BN	-100 (-1.5%)	363 (5.8%)	36 (0.5%)	782 (12.4%)
	D	-182 (-5.2%)	39 (1.2%)	-139 (-4%)	7 (0.2%)
	C	-118 (-3.3%)	71 (2.1%)	-111 (-3.2%)	112 (3.3%)
	All	-72 (-0.6%)	63 (0.6%)	103 (0.9%)	464 (4.1%)
Mar	W	0 (0%)	-4 (-0.02%)	22 (0.1%)	32 (0.2%)
	AN	-241 (-2.6%)	-262 (-3%)	95 (1%)	516 (5.9%)
	BN	-92 (-2.1%)	-80 (-1.9%)	379 (8.5%)	644 (15.2%)
	D	-26 (-0.7%)	239 (6.4%)	-177 (-4.7%)	-7 (-0.2%)
	C	-162 (-4.3%)	-134 (-3.5%)	-21 (-0.5%)	97 (2.5%)
	All	-80 (-0.9%)	-20 (-0.2%)	44 (0.5%)	208 (2.4%)
Apr	W	-20 (-0.2%)	-4 (-0.05%)	25 (0.3%)	146 (1.6%)
	AN	-5 (-0.1%)	32 (0.6%)	42 (0.7%)	6 (0.1%)
	BN	165 (3.3%)	-501 (-9.2%)	317 (6.3%)	-17 (-0.3%)
	D	-171 (-3%)	-274 (-4.7%)	29 (0.5%)	-2 (-0.04%)
	C	-59 (-0.9%)	-74 (-1.1%)	42 (0.7%)	-4 (-0.1%)
	All	-25 (-0.4%)	-153 (-2.2%)	81 (1.2%)	43 (0.6%)
May	W	-29 (-0.4%)	-245 (-3.3%)	-3 (-0.04%)	48 (0.6%)
	AN	-297 (-3.6%)	-249 (-2.8%)	9 (0.1%)	-221 (-2.5%)
	BN	-368 (-5.4%)	-786 (-11%)	428 (6.3%)	214 (3%)
	D	-181 (-2.4%)	-709 (-8.2%)	88 (1.2%)	113 (1.3%)
	C	53 (0.8%)	-140 (-1.9%)	269 (3.9%)	6 (0.1%)
	All	-148 (-1.9%)	-425 (-5.4%)	132 (1.7%)	45 (0.6%)
Jun	W	-245 (-2.4%)	-755 (-6.7%)	5 (0.05%)	150 (1.3%)
	AN	-957 (-7.9%)	-1749 (-12.8%)	80 (0.7%)	-78 (-0.6%)
	BN	-608 (-5.4%)	-1021 (-8.7%)	152 (1.4%)	218 (1.9%)
	D	-659 (-5.4%)	-806 (-6.4%)	-153 (-1.3%)	18 (0.1%)
	C	-268 (-2.4%)	-351 (-3.1%)	2 (0.01%)	-180 (-1.6%)
	All	-505 (-4.5%)	-898 (-7.5%)	6 (0.1%)	51 (0.4%)
Jul	W	-157 (-1.1%)	12 (0.1%)	29 (0.2%)	102 (0.7%)
	AN	35 (0.2%)	-209 (-1.4%)	-6 (-0.04%)	149 (1%)
	BN	-449 (-3.3%)	-180 (-1.4%)	-317 (-2.3%)	70 (0.5%)
	D	-316 (-2.3%)	227 (1.8%)	205 (1.5%)	352 (2.8%)
	C	-667 (-5.4%)	232 (2%)	-184 (-1.5%)	-259 (-2.2%)
	All	-288 (-2.1%)	26 (0.2%)	-28 (-0.2%)	105 (0.8%)

Month	Water-Year Type[a]	Scenarios[b]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	93 (0.9%)	403 (3.9%)	47 (0.4%)	-60 (-0.6%)
	AN	211 (1.9%)	677 (6%)	-165 (-1.5%)	140 (1.2%)
	BN	-82 (-0.8%)	592 (5.8%)	-298 (-2.8%)	-211 (-2.1%)
	D	1447 (15.4%)	1238 (13.1%)	38 (0.4%)	65 (0.7%)
	C	384 (4.7%)	950 (14%)	-135 (-1.7%)	822 (12.2%)
	All	420 (4.2%)	739 (7.6%)	-72 (-0.7%)	100 (1%)
Sep	W	286 (2.4%)	356 (2.7%)	-3739 (-31.9%)	-6084 (-46.1%)
	AN	1117 (14.3%)	838 (9%)	-998 (-12.7%)	-3110 (-33.4%)
	BN	-88 (-1.7%)	685 (14.2%)	835 (16.2%)	680 (14.1%)
	D	265 (5.8%)	170 (3.4%)	525 (11.6%)	108 (2.1%)
	C	74 (1.6%)	12 (0.2%)	316 (6.7%)	-52 (-1%)
	All	308 (4.1%)	391 (4.7%)	-1028 (-13.8%)	-2252 (-27.3%)
Oct	W	147 (2.3%)	-157 (-2.3%)	46 (0.7%)	-458 (-6.6%)
	AN	661 (11.5%)	983 (13.6%)	384 (6.7%)	-360 (-5%)
	BN	389 (6.9%)	-104 (-1.6%)	352 (6.2%)	108 (1.7%)
	D	176 (3%)	462 (7.3%)	-44 (-0.8%)	337 (5.3%)
	C	507 (9.8%)	163 (2.9%)	433 (8.4%)	538 (9.6%)
	All	322 (5.5%)	202 (3.1%)	184 (3.1%)	-27 (-0.4%)
Nov	W	-96 (-1.5%)	131 (2.1%)	-324 (-5%)	-581 (-9.1%)
	AN	376 (6.6%)	646 (11.8%)	-645 (-11.3%)	-909 (-16.6%)
	BN	220 (4.8%)	-167 (-3.4%)	-214 (-4.7%)	-667 (-13.8%)
	D	-53 (-1.1%)	63 (1.4%)	36 (0.8%)	-279 (-6.1%)
	C	-190 (-4.3%)	-167 (-3.8%)	-128 (-2.9%)	-119 (-2.7%)
	All	23 (0.4%)	97 (1.8%)	-245 (-4.6%)	-510 (-9.6%)
Dec	W	108 (0.8%)	303 (2.8%)	975 (7.5%)	1682 (15.5%)
	AN	187 (3.5%)	-154 (-2.8%)	-91 (-1.7%)	-19 (-0.4%)
	BN	136 (2.4%)	-251 (-4.6%)	-46 (-0.8%)	212 (3.9%)
	D	-122 (-3.2%)	-245 (-6.2%)	464 (12%)	342 (8.6%)
	C	-155 (-4.2%)	-29 (-0.8%)	56 (1.5%)	164 (4.5%)
	All	35 (0.5%)	-27 (-0.4%)	398 (5.5%)	666 (10.1%)

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-7. Mean Monthly Flows (cfs) in the Sacramento River upstream of Red Bluff Diversion Dam under ESO, HOS, and LOS Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	29,799	30,699	29,702	30,731	30,146	31,643
	AN	16,960	16,472	16,858	16,376	17,374	18,262
	BN	9,842	9,299	9,623	9,502	9,782	10,082
	D	7,261	6,967	7,260	6,930	7,393	7,202
	C	6,222	7,077	6,216	6,220	6,869	7,484
	All	16,115	16,297	16,031	16,194	16,399	17,103
Feb	W	32,853	33,502	32,967	33,520	32,937	33,983
	AN	25,247	25,402	25,018	25,243	26,040	26,470
	BN	12,855	12,368	12,758	12,729	12,891	13,144
	D	8,843	8,788	8,662	8,828	8,703	8,792
	C	6,527	6,365	6,410	6,443	6,411	6,474
	All	19,203	19,312	19,132	19,376	19,304	19,771
Mar	W	25,481	26,282	25,482	26,280	25,504	26,313
	AN	16,753	16,409	16,522	16,149	16,844	16,920
	BN	8,598	8,402	8,532	8,320	8,975	9,035
	D	8,260	8,238	8,235	8,477	8,085	8,231
	C	6,323	6,362	6,162	6,226	6,305	6,461
	All	14,738	14,909	14,664	14,888	14,781	15,114
Apr	W	15,066	14,719	15,047	14,716	15,091	14,865
	AN	10,090	10,051	10,094	10,086	10,133	10,056
	BN	8,299	8,689	8,467	8,192	8,611	8,671
	D	7,789	7,902	7,618	7,628	7,818	7,897
	C	7,600	7,777	7,546	7,706	7,642	7,772
	All	10,493	10,494	10,470	10,343	10,572	10,536
May	W	11,232	10,464	11,204	10,220	11,227	10,509
	AN	10,502	11,230	10,205	10,982	10,511	11,010
	BN	8,423	8,768	8,056	7,988	8,843	8,976
	D	8,841	9,935	8,661	9,230	8,927	10,043
	C	7,975	8,533	8,031	8,395	8,243	8,538
	All	9,644	9,888	9,498	9,466	9,774	9,930
Jun	W	11,849	12,681	11,606	11,929	11,853	12,828
	AN	12,882	14,358	11,927	12,611	12,960	14,280
	BN	11,988	12,406	11,387	11,393	12,132	12,615
	D	12,699	13,183	12,042	12,383	12,544	13,193
	C	11,748	11,937	11,485	11,590	11,746	11,754
	All	12,196	12,881	11,693	11,987	12,199	12,927
Jul	W	14,157	14,651	14,003	14,668	14,184	14,748
	AN	14,662	14,975	14,701	14,774	14,654	15,122
	BN	13,741	13,098	13,297	12,924	13,415	13,156
	D	13,737	12,859	13,424	13,090	13,942	13,203
	C	12,632	11,851	11,972	12,066	12,446	11,659
	All	13,845	13,630	13,560	13,659	13,814	13,740

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Aug	W	10,773	10,689	10,867	11,092	10,817	10,625
	AN	11,295	11,424	11,504	12,099	11,129	11,561
	BN	10,845	10,277	10,766	10,869	10,542	10,057
	D	9,524	9,582	10,971	10,818	9,559	9,637
	C	8,326	7,128	8,661	8,026	8,202	7,915
	All	10,229	9,962	10,643	10,692	10,157	10,052
Sep	W	12,202	13,674	12,488	14,028	8,461	7,588
	AN	8,255	9,739	9,369	10,572	7,258	6,629
	BN	5,510	5,201	5,423	5,881	6,343	5,878
	D	4,991	5,505	5,246	5,667	5,516	5,608
	C	5,112	5,727	5,156	5,683	5,430	5,660
	All	7,862	8,695	8,163	9,075	6,833	6,439
Oct	W	7,585	8,048	7,730	7,889	7,640	7,612
	AN	6,773	8,257	7,430	9,241	7,161	7,905
	BN	6,376	7,146	6,764	7,029	6,730	7,269
	D	6,648	7,107	6,830	7,562	6,614	7,456
	C	5,951	6,411	6,468	6,553	6,386	6,965
	All	6,815	7,478	7,139	7,673	7,006	7,467
Nov	W	9,839	9,653	9,743	9,787	9,512	9,070
	AN	7,725	7,430	8,101	8,071	7,074	6,522
	BN	6,338	6,597	6,556	6,432	6,120	5,925
	D	6,601	6,480	6,548	6,540	6,635	6,193
	C	5,456	5,416	5,261	5,250	5,324	5,280
	All	7,580	7,489	7,601	7,586	7,332	6,974
Dec	W	21,714	19,469	21,823	19,771	22,690	21,152
	AN	10,021	10,161	10,208	10,004	9,935	10,146
	BN	8,741	8,541	8,876	8,292	8,698	8,757
	D	7,046	7,137	6,925	6,893	7,509	7,478
	C	5,582	5,480	5,429	5,441	5,640	5,647
	All	12,207	11,487	12,243	11,458	12,607	12,155

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-8. Differences between ESO Scenarios and HOS and LOS Scenarios in Mean Monthly Flows (cfs) in the Sacramento River Upstream of the Red Bluff Diversion Dam

Month	Water-Year Type[a]	Scenarios[b]			
		ESO_ELT vs. HOS_ELT[b]	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	-96 (-0.3%)	32 (0.1%)	347 (1.2%)	944 (3.1%)
	AN	-103 (-0.6%)	-97 (-0.6%)	413 (2.4%)	1790 (10.9%)
	BN	-219 (-2.2%)	203 (2.2%)	-59 (-0.6%)	782 (8.4%)
	D	0 (0%)	-36 (-0.5%)	133 (1.8%)	235 (3.4%)
	C	-6 (-0.1%)	-857 (-12.1%)	647 (10.4%)	407 (5.7%)
	All	-84 (-0.5%)	-103 (-0.6%)	284 (1.8%)	806 (4.9%)
Feb	W	114 (0.3%)	18 (0.1%)	83 (0.3%)	482 (1.4%)
	AN	-229 (-0.9%)	-158 (-0.6%)	792 (3.1%)	1069 (4.2%)
	BN	-97 (-0.8%)	361 (2.9%)	36 (0.3%)	776 (6.3%)
	D	-181 (-2%)	40 (0.5%)	-140 (-1.6%)	5 (0.1%)
	C	-118 (-1.8%)	78 (1.2%)	-116 (-1.8%)	110 (1.7%)
	All	-71 (-0.4%)	65 (0.3%)	101 (0.5%)	459 (2.4%)
Mar	W	0 (0%)	-3 (-0.01%)	23 (0.1%)	31 (0.1%)
	AN	-231 (-1.4%)	-259 (-1.6%)	91 (0.5%)	512 (3.1%)
	BN	-65 (-0.8%)	-82 (-1%)	377 (4.4%)	633 (7.5%)
	D	-25 (-0.3%)	239 (2.9%)	-175 (-2.1%)	-7 (-0.1%)
	C	-161 (-2.5%)	-136 (-2.1%)	-18 (-0.3%)	99 (1.6%)
	All	-74 (-0.5%)	-20 (-0.1%)	44 (0.3%)	206 (1.4%)
Apr	W	-19 (-0.1%)	-3 (-0.02%)	25 (0.2%)	146 (1%)
	AN	5 (0.05%)	35 (0.3%)	43 (0.4%)	5 (0.1%)
	BN	168 (2%)	-497 (-5.7%)	312 (3.8%)	-17 (-0.2%)
	D	-171 (-2.2%)	-274 (-3.5%)	29 (0.4%)	-5 (-0.1%)
	C	-54 (-0.7%)	-71 (-0.9%)	42 (0.6%)	-4 (-0.1%)
	All	-22 (-0.2%)	-151 (-1.4%)	80 (0.8%)	42 (0.4%)
May	W	-28 (-0.3%)	-244 (-2.3%)	-5 (-0.04%)	46 (0.4%)
	AN	-297 (-2.8%)	-249 (-2.2%)	9 (0.1%)	-220 (-2%)
	BN	-367 (-4.4%)	-780 (-8.9%)	420 (5%)	208 (2.4%)
	D	-180 (-2%)	-705 (-7.1%)	86 (1%)	108 (1.1%)
	C	56 (0.7%)	-138 (-1.6%)	268 (3.4%)	5 (0.1%)
	All	-146 (-1.5%)	-422 (-4.3%)	130 (1.3%)	42 (0.4%)
Jun	W	-244 (-2.1%)	-752 (-5.9%)	3 (0.03%)	147 (1.2%)
	AN	-955 (-7.4%)	-1747 (-12.2%)	78 (0.6%)	-78 (-0.5%)
	BN	-601 (-5%)	-1013 (-8.2%)	144 (1.2%)	209 (1.7%)
	D	-657 (-5.2%)	-800 (-6.1%)	-155 (-1.2%)	10 (0.1%)
	C	-264 (-2.2%)	-346 (-2.9%)	-2 (-0.02%)	-182 (-1.5%)
	All	-503 (-4.1%)	-893 (-6.9%)	3 (0.02%)	46 (0.4%)
Jul	W	-155 (-1.1%)	17 (0.1%)	27 (0.2%)	97 (0.7%)
	AN	40 (0.3%)	-201 (-1.3%)	-8 (-0.1%)	147 (1%)
	BN	-443 (-3.2%)	-174 (-1.3%)	-325 (-2.4%)	58 (0.4%)
	D	-313 (-2.3%)	231 (1.8%)	204 (1.5%)	344 (2.7%)
	C	-660 (-5.2%)	215 (1.8%)	-186 (-1.5%)	-192 (-1.6%)
	All	-284 (-2.1%)	28 (0.2%)	-31 (-0.2%)	110 (0.8%)

Month	Water-Year Type[a]	Scenarios[b]			
		ESO_ELT vs. HOS_ELT[b]	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	94 (0.9%)	403 (3.8%)	44 (0.4%)	-64 (-0.6%)
	AN	209 (1.8%)	676 (5.9%)	-166 (-1.5%)	137 (1.2%)
	BN	-78 (-0.7%)	592 (5.8%)	-303 (-2.8%)	-220 (-2.1%)
	D	1447 (15.2%)	1236 (12.9%)	35 (0.4%)	55 (0.6%)
	C	335 (4%)	898 (12.6%)	-125 (-1.5%)	788 (11%)
	All	414 (4%)	730 (7.3%)	-73 (-0.7%)	90 (0.9%)
Sep	W	286 (2.3%)	354 (2.6%)	-3741 (-30.7%)	-6085 (-44.5%)
	AN	1114 (13.5%)	832 (8.5%)	-998 (-12.1%)	-3111 (-31.9%)
	BN	-87 (-1.6%)	681 (13.1%)	834 (15.1%)	677 (13%)
	D	255 (5.1%)	162 (2.9%)	525 (10.5%)	103 (1.9%)
	C	44 (0.9%)	-44 (-0.8%)	317 (6.2%)	-67 (-1.2%)
	All	301 (3.8%)	380 (4.4%)	-1028 (-13.1%)	-2256 (-25.9%)
Oct	W	145 (1.9%)	-158 (-2%)	55 (0.7%)	-436 (-5.4%)
	AN	657 (9.7%)	984 (11.9%)	388 (5.7%)	-352 (-4.3%)
	BN	388 (6.1%)	-118 (-1.6%)	354 (5.5%)	123 (1.7%)
	D	182 (2.7%)	455 (6.4%)	-34 (-0.5%)	349 (4.9%)
	C	517 (8.7%)	141 (2.2%)	434 (7.3%)	554 (8.6%)
	All	324 (4.8%)	194 (2.6%)	191 (2.8%)	-11 (-0.1%)
Nov	W	-96 (-1%)	134 (1.4%)	-327 (-3.3%)	-583 (-6%)
	AN	377 (4.9%)	641 (8.6%)	-650 (-8.4%)	-908 (-12.2%)
	BN	217 (3.4%)	-165 (-2.5%)	-218 (-3.4%)	-672 (-10.2%)
	D	-54 (-0.8%)	60 (0.9%)	34 (0.5%)	-287 (-4.4%)
	C	-195 (-3.6%)	-166 (-3.1%)	-131 (-2.4%)	-136 (-2.5%)
	All	21 (0.3%)	97 (1.3%)	-248 (-3.3%)	-515 (-6.9%)
Dec	W	109 (0.5%)	302 (1.6%)	976 (4.5%)	1683 (8.6%)
	AN	186 (1.9%)	-157 (-1.5%)	-86 (-0.9%)	-15 (-0.1%)
	BN	135 (1.5%)	-249 (-2.9%)	-43 (-0.5%)	216 (2.5%)
	D	-121 (-1.7%)	-244 (-3.4%)	463 (6.6%)	342 (4.8%)
	C	-153 (-2.7%)	-39 (-0.7%)	58 (1%)	167 (3.1%)
	All	36 (0.3%)	-29 (-0.3%)	400 (3.3%)	668 (5.8%)

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

The probability of exceeding a set of instream flow threshold criteria for the Sacramento, Feather, and American Rivers used in the Operations Criteria and Plan (OCAP) Biological Opinion (BiOp) (National Marine Fisheries Service 2009) and Oroville BiOp (National Marine Fisheries Service in prep.) was used to determine potential effects of the ESO relative to EBC2 during the early and late long-term implementation periods (Table 5C.5.2-9). Daily data from the Sacramento River Water Quality Model (SRWQM) were used for the Sacramento River, and monthly CALSIM outputs were used for the Feather and American Rivers.

Table 5C.5.2-9. Minimum Flow Criteria Established by NMFS (2009, in prep.) and Used in the BDCP Effects Analysis

Location	Period	Minimum Flow	Purpose
Upper Sacramento River			
Below Keswick Dam	Year-round	4,000 cfs	To keep side channels flowing
American River			
Below Nimbus Dam	Year-round	1,750 cfs	Critical habitat features
Feather River			
Low-Flow Channel	Apr–Aug	700 cfs	Critical habitat features
Low-Flow Channel	Sep–Mar	800 cfs	Critical habitat features
High-Flow Channel	Oct–Mar	1,700 cfs	Critical habitat features
High-Flow Channel	Apr–Sep	1,000 cfs	Critical habitat features

Results of this analysis by water-year type for the 4,000 cfs criterion in the Sacramento River below Keswick Dam are reported in Table 5C.5.2-10 and differences between model scenarios are reported in Table 5C.5.2-11 (Feather River and American River results are presented in Sections 5C.5.2.4.1.1 and Section 5C.5.2.5.1.1, respectively). These results indicate that the probability of exceeding this minimum threshold to keep side channels flowing in the Sacramento River is nearly identical (<2% difference) between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. This indicates that the ESO would have few, if any, effects to keeping side channels wet in the Sacramento River throughout the year.

Results of this analysis for HOS and LOS are presented in Table 5C.5.2-12 and differences between the ESO scenario and HOS and LOS are presented in Table 5C.5.2-13. These results indicate that flows under the HOS and LOS would not exceed the 4,000 cfs criterion any less often than the ESO. The only meaningful (>5%) difference would occur in critical water years in which the frequency of exceedance above the 4,000 cfs threshold under LOS_LLT would increase relative to the frequency under ESO_LLT. Therefore, the frequency of exceedance would generally be similar between the ESO scenario and HOS and LOS.

Table 5C.5.2-10. Percentage of Days that Exceed the Year-Round 4,000 cfs Flow Threshold in the Sacramento River below Keswick Dam

Water-Year Type[a]	Scenario[b]					
	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
W	91.6	92.2	91.8	90.2	91.2	90.2
AN	87.6	86.1	84.6	85.3	84.4	85.1
BN	77.4	73.7	73.1	73.5	73.3	73.9
D	71.7	70.6	67.8	66.5	66.8	68.0
C	69.0	68.4	64.1	59.6	65.2	60.3
All	80.9	79.9	78.2	76.9	78.0	77.4

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-11. Differences[a] between EBC and ESO Scenarios in the Percentage of Days that Exceed the Year-Round 4,000 cfs Flow Threshold in the Sacramento River below Keswick Dam

Water-Year Type[b]	Scenarios[c]					
	EBC1 vs. ESO_ELT[c]	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
W	-0.4 (-0.4%)	-1.4 (-1.5%)	-1 (-1.1%)	-1 (-1.1%)	-0.6 (-0.6%)	0 (0%)
AN	-3.3 (-3.7%)	-2.5 (-2.9%)	-1.8 (-2%)	-1.8 (-2%)	-0.3 (-0.4%)	-0.2 (-0.2%)
BN	-4.1 (-5.3%)	-3.5 (-4.5%)	-0.4 (-0.6%)	-0.4 (-0.6%)	0.2 (0.3%)	0.4 (0.5%)
D	-4.9 (-6.8%)	-3.7 (-5.2%)	-3.8 (-5.3%)	-3.8 (-5.3%)	-1 (-1.5%)	1.5 (2.3%)
C	-3.8 (-5.5%)	-8.7 (-12.6%)	-3.1 (-4.6%)	-3.1 (-4.6%)	1.1 (1.8%)	0.8 (1.3%)
All	-2.9 (-3.6%)	-3.5 (-4.3%)	-1.9 (-2.4%)	-1.9 (-2.4%)	-0.2 (-0.3%)	0.5 (0.6%)

[a] Positive values indicate a higher percentange of days that exceed threshold in the ESO than in EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-12. Percentage of Days that Exceed the Year-Round 4,000 cfs Flow Threshold in the Sacramento River below Keswick Dam under ESO, HOS, and LOS Scenarios

Water-Year Type[a]	Scenario[b]					
	ESO_ELT[b]	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
W	91.2	90.2	91.4	90.0	91.1	88.9
AN	84.4	85.1	85.2	85.4	84.5	86.5
BN	73.3	73.9	72.9	71.4	75.5	76.2
D	66.8	68.0	66.7	65.7	70.0	69.0
C	65.2	60.3	63.9	61.4	67.9	64.1
All	78.0	77.4	77.9	76.6	79.5	78.4

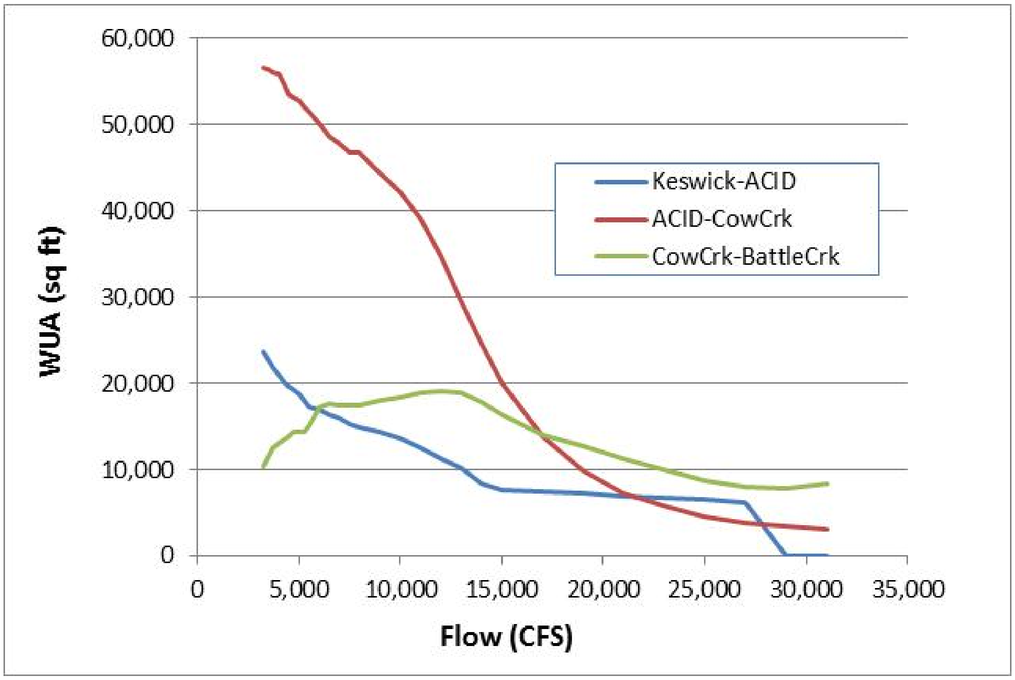
[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-13. Differences[a] between ESO Scenarios and HOS and LOS Scenarios in the Percentage of Days that Exceed the Year-Round 4,000 cfs Flow Threshold in the Sacramento River below Keswick Dam

Water-Year Type[b]	Scenarios[c]			
	ESO_ELT vs. HOS_ELT[c]	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
W	0.2 (0.2%)	-0.1 (-0.2%)	-0.1 (-0.1%)	-1.2 (-1.4%)
AN	0.8 (0.9%)	0.2 (0.3%)	0.2 (0.2%)	1.4 (1.6%)
BN	-0.4 (-0.5%)	-2.5 (-3.4%)	2.2 (3%)	2.3 (3.1%)
D	0 (-0.1%)	-2.3 (-3.4%)	3.2 (4.8%)	1 (1.5%)
C	-1.3 (-2%)	1.1 (1.8%)	2.7 (4.1%)	3.7 (6.2%)
All	-0.1 (-0.1%)	-0.8 (-1%)	1.5 (1.9%)	1 (1.3%)

[a] Positive values indicate a higher percentage of days that exceed the threshold in HOS or LOS than in ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

The SacEFT model was used to determine the effects of the ESO on spawning, egg incubation, and juvenile rearing habitat value and quantity for steelhead in the upper Sacramento River. SacEFT analyses of habitat conditions for steelhead spawning are based on weighted usable area (WUA) derived from the Instream Flow Incremental Method (IFIM) habitat study on the mainstem Sacramento River (U.S. Fish and Wildlife Service 2003). Flow–WUA relationships for multiple segments of the river were developed by Gard (U.S. Fish and Wildlife Service 2005a) to predict the effect of flow on WUA in each river segment. In Gard's framework, each run-type has a unique empirical Flow-WUA relationship. Relationships for Steelhead are shown in Figure 5C.5.2-25.



Source: U.S. Fish and Wildlife Service 2003: Figure 29; Adapted for SacEFT.

Figure 5C.5.2-25. Spawning Weighted Usable Area (WUA) for Steelhead Trout in the Three River Segments Used by SacEFT Using flow data from Keswick (RM 301) and Cow Creek (RM280) (Historical or Simulated)

The Flow-WUA relationship measures only habitat suitability for spawning, and the SacEFT model largely avoids life-cycle components (e.g., number of redds, spawners, smolts). A statement in the Table 4.7 of the SacEFT documentation is misleading in this regard. The table states "plausible distributions or default distributions must be found for steelhead and spring-run Chinook." This may give the false impression that such distributions are actually used by EFT, whereas they are presented only to show the good correlation between WUA and historical redd counts. Paradoxically, a simulation scenario may result in high Spawning WUA (good habitat) but in the real world there might be few spawners to take advantage of the good habitat. When daily flow falls outside the limits of the curve (minimum 3,250 cfs; maximum 31,000 cfs), WUA is fixed at the minimum or maximum. The frequency of exceeding the upper and lower limits depends on the run-type (i.e., the time of year in which spawning occurs). For example, in the case of winter-spawning Steelhead, regardless of BDCP scenario (EBC1, EBC2, ESO), about 7% of daily flows exceed the upper limit of 31,000 cfs limit and about 1% fall below the lower limit. In the case of summer-spawning winter-run Chinook, only 2% of days fall above the range of the curve and less than 1% fall below the range.

Although SacEFT operates on a daily time step, results are presented in terms of the percent of years that are classified as "good," "worrisome," and "poor," which are defined differently for each parameter analyzed. Classifications are usually based on the tercile breakpoints of the historical distribution for each indicator, and are non-linear (see Attachment 5C.B, *Sacramento River Ecological Flows Tool (SacEFT): Record of Design (v.2.00)* for further details). SacEFT predicts that spawning habitat conditions were classified as "good" in 48% of the years under EBC1, 51% of the years under EBC2, and 48% of the years under both EBC2_ELT and ESO_ELT scenarios (Table 5C.5.2-14). Spawning conditions are predicted to be good in 51% of the years under EBC2_LLT and in 46% of the years under ESO_LLT operations. The reduction (5%) in the percent of years with good habitat area and increase in the percent of years with "worrisome" habitat area for ESO_LLT relative to EBC2_LLT suggests that there would be a small reduction in the availability of suitable habitat for steelhead spawning.

Table 5C.5.2-14. Percentage of Years with Each Rating[a] from SacEFT for Steelhead Habitat Metrics in the Upper Sacramento River

		Scenario[b]					
Metric	**Rating**	**EBC1[b]**	**EBC2**	**EBC2_ELT**	**EBC2_LLT**	**ESO_ELT**	**ESO_LLT**
Spawning WUA	Good	48	51	48	51	48	46
	Worrisome	32	31	35	31	35	36
	Poor	20	18	17	18	17	18
Redd Scour Risk	Good	83	83	80	80	80	80
	Worrisome	5	5	8	6	8	6
	Poor	12	12	12	14	12	14
Egg Incubation	Good	100	100	100	100	100	100
	Worrisome	0	0	0	0	0	0
	Poor	0	0	0	0	0	0
Redd Dewatering Risk	Good	57	55	56	54	56	57
	Worrisome	17	18	15	19	18	20
	Poor	26	27	29	27	26	23
Juvenile Rearing WUA	Good	41	43	45	45	42	35
	Worrisome	45	40	38	43	41	51
	Poor	14	17	17	12	17	14
Juvenile Stranding Risk	Good	34	40	29	20	25	22
	Worrisome	49	37	49	46	50	46
	Poor	17	23	22	34	25	32

[a] See Attachment 5C.B, *Sacramento River Ecological Flows Tool (SacEFT): Record of Design (v.2.00)*, for definition of "good", "worrisome", and "poor" for each performance measure.
[b] See Table 5C.0-1 for definitions of the scenarios.
WUA = Weighted Usable Area.

High-flow events have the potential to scour redds and eggs during incubation, resulting in increased egg mortality. SacEFT calculates the redd scour performance measure by including both flow value and the proportion of eggs exposed to that flow. Results of SacEFT showed that the risk of redd scour was classified as good (reduced risk) 83% of the time for both EBC1 and EBC2, and 80% of the time for both EBC2_ELT and ESO_ELT (Table 5C.5.2-14). Redd scour was also classified as good 80% of the time for EBC2_LLT and ESO_LLT. These results indicate that redd scour risk would be equal between EBC2 and ESO in both the early and late long-term implementation periods.

The SacEFT model was not run for HOS and LOS model scenarios due to similarities in flows in the Sacramento River between the ESO model scenario and HOS and LOS scenarios (Table 5C.5.2-6, Table 5C.5.2-8).

Water Temperature

Steelhead are a coldwater fish species. Exposure of sensitive life stages, such as incubating eggs and rearing juveniles, to elevated water temperatures results in adverse sublethal and lethal effects. Because steelhead inhabiting the Central Valley rivers are near the southern boundary of the geographic distribution, and climate conditions are warm, the effects of seasonally elevated water temperatures have been recognized as a major stressor on salmonids under existing biological conditions. The construction of dams has limited the access of steelhead to cold water farther upstream that was used historically as spawning habitat (McEwan 2001). The potential for adverse temperature effects is expected to become worse in the future as a result of climate change. Therefore, the effects of water temperature are an important factor to consider in assessing changes in habitat suitability for salmonids as part of this effects analysis.

Predicted average water temperatures by month and water-year type for the Sacramento River at Keswick and Bend Bridge, representative sites in the upper Sacramento River, are presented in Table 5C.5.2-15 and Table 5C.5.2-16, respectively and differences between model scenarios are presented in Table 5C.5.2-17 and Table 5C.5.2-18, respectively. These results indicate that there would be very small (<2%) differences in water temperature in the Sacramento River at Keswick or Bend Bridge in all months and water-year types between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. The largest change in temperature averaged across water-year types at these locations would be an increase of 0.1°F, or 1.7%, which would occur at Bend Bridge in below normal water years during September.

Mean monthly water temperatures for ESO, HOS, and LOS scenarios in the Sacramento River at Keswick and upstream of RBDD are presented in Table 5C.5.2-19 and and differences between the ESO scenario and HOS and LOS scenarios are presented in Table 5C.5.2-21 and Table 5C.5.2-22. These results indicate that water temperatures in the Sacramento River throughout the year under the HOS and LOS scenarios would not differ from those under ESO. Therefore, water temperatures under HOS and LOS would be similar to those under EBC2 in both the ELT and LLT.

Table 5C.5.2-15. Mean Monthly Water Temperature (°F) in the Sacramento River at Keswick under EBC and ESO Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	46	46	46	47	46	47
	AN	46	46	47	48	47	48
	BN	47	47	47	48	47	48
	D	47	47	47	48	48	48
	C	47	47	47	48	47	48
	All	46	46	47	48	47	48
Feb	W	45	45	46	47	46	47
	AN	46	45	46	47	46	47
	BN	46	45	46	47	46	47
	D	46	46	47	48	47	48
	C	46	46	47	48	47	48
	All	46	46	46	47	46	47
Mar	W	46	46	47	47	47	47
	AN	46	46	47	48	47	48
	BN	47	47	47	48	48	48
	D	47	47	48	49	48	49
	C	48	48	49	50	49	49
	All	47	47	47	48	47	48
Apr	W	47	47	48	49	48	49
	AN	48	48	49	50	49	50
	BN	48	48	49	50	49	50
	D	48	48	49	50	49	50
	C	49	49	50	51	50	51
	All	48	48	49	50	49	50
May	W	49	49	49	50	50	50
	AN	49	49	50	51	50	50
	BN	49	49	50	51	50	51
	D	49	49	50	51	50	51
	C	51	51	52	53	52	53
	All	49	49	50	51	50	51
Jun	W	50	50	50	51	50	51
	AN	50	50	50	51	50	51
	BN	50	50	50	51	50	51
	D	50	50	51	52	51	52
	C	53	52	54	55	53	55
	All	50	50	51	52	51	52
Jul	W	51	51	51	52	51	52
	AN	51	51	51	52	51	52
	BN	51	51	51	52	51	52
	D	51	51	52	54	52	54
	C	54	55	57	59	56	59
	All	51	51	52	53	52	54

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Aug	W	52	52	53	54	53	54
	AN	52	52	53	54	53	55
	BN	52	52	53	54	53	55
	D	53	53	54	56	54	56
	C	57	57	60	64	60	64
	All	53	53	54	56	54	56
Sep	W	53	53	54	55	54	55
	AN	54	53	54	56	55	56
	BN	54	54	55	56	55	57
	D	55	55	57	59	57	59
	C	60	60	64	66	63	66
	All	55	55	56	58	56	58
Oct	W	54	54	55	57	55	57
	AN	54	54	55	57	55	57
	BN	54	55	56	57	55	58
	D	55	55	57	58	57	59
	C	56	56	58	60	58	60
	All	54	55	56	58	56	58
Nov	W	53	53	54	55	54	55
	AN	52	52	53	55	53	55
	BN	53	53	54	55	54	55
	D	53	53	54	56	54	56
	C	54	54	55	56	55	56
	All	53	53	54	55	54	55
Dec	W	49	49	50	50	50	50
	AN	49	49	50	51	50	51
	BN	50	50	51	52	51	52
	D	50	50	51	52	51	52
	C	51	51	51	52	51	52
	All	50	50	50	51	50	51

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-16. Mean Monthly Water Temperature (°F) in the Sacramento River at Bend Bridge under EBC and ESO Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	45	45	46	47	46	47
	AN	45	45	46	47	46	47
	BN	45	45	45	46	45	46
	D	45	45	46	47	46	47
	C	45	45	46	47	46	47
	All	45	45	46	47	46	47
Feb	W	46	46	47	47	47	47
	AN	46	46	47	48	47	48
	BN	46	46	47	48	47	48
	D	46	46	47	48	47	48
	C	47	47	48	49	48	49
	All	46	46	47	48	47	48
Mar	W	48	48	49	50	49	50
	AN	49	49	50	51	50	51
	BN	49	49	50	51	50	51
	D	50	50	51	52	51	52
	C	50	50	51	52	51	52
	All	49	49	50	51	50	51
Apr	W	51	51	52	53	52	53
	AN	53	53	54	55	54	55
	BN	53	53	54	55	54	55
	D	53	53	54	55	54	54
	C	52	53	53	54	53	54
	All	52	52	53	54	53	54
May	W	54	54	56	57	56	57
	AN	55	55	57	57	56	57
	BN	55	55	56	57	56	57
	D	55	55	56	56	56	56
	C	55	56	57	57	57	58
	All	55	55	56	57	56	57
Jun	W	56	56	57	57	56	57
	AN	55	55	56	57	56	56
	BN	55	55	56	57	56	56
	D	55	55	56	57	56	57
	C	57	57	58	59	57	59
	All	55	55	56	57	56	57
Jul	W	56	56	57	57	57	57
	AN	55	55	56	57	56	57
	BN	55	55	56	57	56	57
	D	56	56	57	58	57	59
	C	58	58	60	63	60	63
	All	56	56	57	58	57	58

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Aug	W	57	57	58	59	58	59
	AN	57	57	58	59	58	59
	BN	56	56	58	59	58	59
	D	57	57	59	60	59	61
	C	60	60	63	67	63	67
	All	57	57	59	60	59	61
Sep	W	57	56	57	58	57	58
	AN	58	57	58	59	58	60
	BN	58	58	59	60	60	62
	D	58	59	61	63	61	63
	C	62	62	65	67	64	67
	All	58	58	59	61	60	61
Oct	W	54	55	56	57	56	57
	AN	55	55	56	57	56	57
	BN	55	55	56	58	56	58
	D	55	55	57	58	57	59
	C	56	56	58	60	58	60
	All	55	55	56	58	56	58
Nov	W	51	51	52	53	51	53
	AN	51	51	52	53	51	53
	BN	51	51	52	53	52	53
	D	51	51	52	54	52	53
	C	52	52	53	54	53	54
	All	51	51	52	53	52	53
Dec	W	47	46	47	48	47	48
	AN	46	46	47	48	47	48
	BN	47	47	47	49	47	49
	D	46	46	47	48	47	48
	C	47	47	48	49	48	49
	All	47	46	47	48	47	48

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-17. Differences between EBC and ESO Scenarios in Mean Monthly Water Temperature (°F) in the Sacramento River at Keswick

Month	Water-Year Type[a]	Scenarios[b]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	1 (1.2%)	1 (2.8%)	1 (1.3%)	1 (3%)	0.04 (0.1%)	-0.1 (-0.1%)
	AN	1 (1.4%)	1 (3.2%)	1 (1.5%)	2 (3.3%)	0 (0%)	0.03 (0.1%)
	BN	1 (1.7%)	2 (3.4%)	1 (1.7%)	2 (3.4%)	0.1 (0.1%)	-0.1 (-0.2%)
	D	1 (1.7%)	2 (3.3%)	1 (1.6%)	2 (3.2%)	0.1 (0.1%)	-0.1 (-0.1%)
	C	1 (1.8%)	2 (3.6%)	1 (1.8%)	2 (3.7%)	0.1 (0.1%)	-0.1 (-0.2%)
	All	1 (1.5%)	1 (3.2%)	1 (1.6%)	2 (3.3%)	0.04 (0.1%)	-0.1 (-0.1%)
Feb	W	1 (1.7%)	2 (3.4%)	1 (1.8%)	2 (3.4%)	0.03 (0.1%)	0 (0%)
	AN	1 (1.8%)	2 (3.6%)	1 (1.9%)	2 (3.7%)	0.1 (0.2%)	0.03 (0.1%)
	BN	1 (1.8%)	2 (3.3%)	1 (1.9%)	2 (3.4%)	0.05 (0.1%)	-0.03 (-0.1%)
	D	1 (1.9%)	2 (3.5%)	1 (1.9%)	2 (3.6%)	0 (0%)	-0.1 (-0.2%)
	C	1 (2%)	2 (3.7%)	1 (2.1%)	2 (3.7%)	0.1 (0.1%)	-0.1 (-0.2%)
	All	1 (1.8%)	2 (3.5%)	1 (1.9%)	2 (3.5%)	0.04 (0.1%)	-0.03 (-0.1%)
Mar	W	1 (1.6%)	1 (3.2%)	1 (1.6%)	2 (3.3%)	0.03 (0.1%)	0 (0%)
	AN	1 (1.9%)	2 (3.6%)	1 (2%)	2 (3.7%)	0.1 (0.2%)	0 (0.1%)
	BN	1 (1.8%)	2 (3.4%)	1 (2.1%)	2 (3.7%)	0.1 (0.3%)	0 (0.1%)
	D	1 (1.8%)	2 (3.4%)	1 (1.8%)	2 (3.4%)	0.04 (0.1%)	-0.1 (-0.1%)
	C	1 (1.9%)	2 (3.5%)	1 (1.8%)	2 (3.5%)	0.04 (0.1%)	-0.2 (-0.5%)
	All	1 (1.8%)	2 (3.4%)	1 (1.8%)	2 (3.5%)	0.1 (0.1%)	-0.03 (-0.1%)
Apr	W	1 (1.7%)	2 (3.4%)	1 (1.7%)	2 (3.5%)	0.04 (0.1%)	-0.04 (-0.1%)
	AN	1 (1.7%)	2 (3.6%)	1 (1.8%)	2 (3.6%)	0.1 (0.2%)	0 (0%)
	BN	1 (1.6%)	1 (3.1%)	1 (1.7%)	2 (3.2%)	0.1 (0.2%)	0.1 (0.3%)
	D	1 (1.5%)	1 (3%)	1 (1.4%)	1 (3%)	0 (0%)	-0.1 (-0.2%)
	C	1 (2%)	2 (4.1%)	1 (1.7%)	2 (3.9%)	0.03 (0.1%)	-0.06 (-0.1%)
	All	1 (1.7%)	2 (3.4%)	1 (1.7%)	2 (3.4%)	0.05 (0.1%)	0 (0%)
May	W	1 (1.8%)	2 (3.3%)	1 (1.8%)	2 (3.4%)	0 (0%)	-0.1 (-0.2%)
	AN	1 (1.3%)	1 (2.5%)	1 (1.3%)	1 (2.5%)	-0.1 (-0.2%)	-0.1 (-0.2%)
	BN	1 (1.8%)	1 (2.8%)	1 (1.7%)	1 (2.7%)	0.04 (0.1%)	0 (0%)
	D	1 (1.6%)	1 (2.9%)	1 (1.6%)	1 (2.9%)	-0.09 (-0.2%)	-0.1 (-0.2%)
	C	1 (1.8%)	2 (4.4%)	1 (1.7%)	2 (4.3%)	0 (0%)	0.2 (0.4%)
	All	1 (1.7%)	2 (3.2%)	1 (1.7%)	2 (3.2%)	0 (0%)	-0.04 (-0.1%)
Jun	W	0 (0.9%)	1 (1.7%)	0 (0.9%)	1 (1.7%)	0 (0%)	-0.1 (-0.2%)
	AN	1 (1.2%)	1 (2.1%)	1 (1.4%)	1 (2.2%)	0.04 (0.1%)	-0.2 (-0.4%)
	BN	0 (1%)	1 (2.2%)	1 (1.1%)	1 (2.3%)	0 (0%)	-0.1 (-0.3%)
	D	1 (1.9%)	2 (4%)	1 (1.7%)	2 (3.9%)	0 (0%)	0.1 (0.3%)
	C	1 (1.7%)	2 (4.5%)	1 (1.7%)	2 (4.6%)	-0.2 (-0.3%)	0.3 (0.5%)
	All	1 (1.3%)	1 (2.8%)	1 (1.3%)	1 (2.8%)	-0.03 (-0.1%)	0 (0%)
Jul	W	0 (0.7%)	1 (2.2%)	0 (0.8%)	1 (2.3%)	0 (0%)	0.2 (0.4%)
	AN	1 (1.5%)	2 (3.4%)	1 (1.6%)	2 (3.5%)	0.2 (0.3%)	0.3 (0.6%)
	BN	1 (1.2%)	2 (3.3%)	1 (1.3%)	2 (3.3%)	0 (0%)	0.3 (0.6%)
	D	1 (2.3%)	3 (5.7%)	1 (2%)	3 (5.4%)	0.2 (0.3%)	1 (1.1%)
	C	2 (4.1%)	5 (9.4%)	2 (3.3%)	5 (8.5%)	-0.1 (-0.2%)	-0.1 (-0.1%)
	All	1 (1.8%)	2 (4.4%)	1 (1.6%)	2 (4.3%)	0.04 (0.1%)	0.3 (0.5%)

Month	Water-Year Type[a]	Scenarios[b]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Aug	W	1 (1.9%)	2 (4.1%)	1 (1.8%)	2 (4%)	0.1 (0.2%)	0.2 (0.4%)
	AN	1 (1.7%)	2 (4.4%)	1 (1.7%)	2 (4.4%)	0.1 (0.2%)	0.4 (0.8%)
	BN	1 (2.5%)	3 (5.6%)	1 (2.4%)	3 (5.6%)	0.2 (0.4%)	1 (1%)
	D	2 (3.2%)	3 (6.3%)	2 (3%)	3 (6.1%)	0.2 (0.4%)	0.3 (0.5%)
	C	3 (5.9%)	8 (13.7%)	3 (5.6%)	8 (13.3%)	-0.4 (-0.7%)	0.3 (0.4%)
	All	2 (2.9%)	3 (6.4%)	1 (2.7%)	3 (6.3%)	0.1 (0.1%)	0.3 (0.6%)
Sep	W	1 (1.2%)	2 (3.6%)	1 (1.6%)	2 (3.9%)	0.1 (0.3%)	0.3 (0.5%)
	AN	1 (2%)	3 (5%)	1 (2.4%)	3 (5.4%)	1 (0.9%)	0.4 (0.8%)
	BN	2 (3.3%)	4 (6.7%)	2 (3.3%)	4 (6.7%)	1 (1.4%)	1 (1.6%)
	D	2 (3.5%)	4 (7.8%)	2 (3.1%)	4 (7.5%)	-0.03 (-0.1%)	-0.1 (-0.2%)
	C	3 (5%)	6 (10.3%)	3 (5.4%)	6 (10.8%)	-0.4 (-0.6%)	0.3 (0.4%)
	All	2 (2.8%)	3 (6.3%)	2 (2.9%)	4 (6.5%)	0.2 (0.3%)	0.3 (0.5%)
Oct	W	1 (2.7%)	3 (6.2%)	1 (2%)	3 (5.4%)	0.1 (0.2%)	0.3 (0.5%)
	AN	1 (2.5%)	3 (5.6%)	1 (1.7%)	3 (4.7%)	0.05 (0.1%)	0.2 (0.4%)
	BN	1 (2.2%)	3 (6%)	1 (1.7%)	3 (5.4%)	-0.1 (-0.1%)	0.2 (0.4%)
	D	2 (3.3%)	4 (7.1%)	1 (2.6%)	4 (6.4%)	0.1 (0.2%)	0.4 (0.7%)
	C	1 (2.5%)	4 (6.6%)	1 (2.6%)	4 (6.7%)	-0.4 (-0.7%)	-0.04 (-0.1%)
	All	1 (2.7%)	3 (6.3%)	1 (2.1%)	3 (5.7%)	0 (0%)	0.2 (0.4%)
Nov	W	1 (2%)	2 (4.4%)	1 (1.5%)	2 (3.9%)	-0.1 (-0.1%)	0.1 (0.1%)
	AN	1 (1.7%)	2 (4.4%)	1 (1.6%)	2 (4.4%)	-0.1 (-0.3%)	0.1 (0.2%)
	BN	1 (1.6%)	2 (4.6%)	1 (1.1%)	2 (4.2%)	-0.2 (-0.4%)	0 (0%)
	D	1 (2.1%)	2 (4.6%)	1 (1.8%)	2 (4.3%)	0 (0%)	0 (0.1%)
	C	1 (1.8%)	2 (4.3%)	1 (1.7%)	2 (4.2%)	-0.2 (-0.3%)	-0.1 (-0.3%)
	All	1 (1.9%)	2 (4.5%)	1 (1.6%)	2 (4.2%)	-0.1 (-0.2%)	0.04 (0.1%)
Dec	W	1 (1.1%)	1 (2.5%)	1 (1.3%)	1 (2.7%)	0 (0%)	-0.05 (-0.1%)
	AN	1 (1.5%)	2 (3.5%)	1 (1.4%)	2 (3.4%)	-0.1 (-0.3%)	-0.03 (-0.1%)
	BN	1 (1.6%)	2 (3.8%)	1 (1.5%)	2 (3.8%)	-0.1 (-0.2%)	-0.1 (-0.2%)
	D	1 (1.6%)	2 (3.6%)	1 (1.6%)	2 (3.5%)	-0.04 (-0.1%)	-0.1 (-0.3%)
	C	1 (1.6%)	2 (3.6%)	1 (1.6%)	2 (3.6%)	-0.1 (-0.1%)	-0.1 (-0.3%)
	All	1 (1.4%)	2 (3.3%)	1 (1.4%)	2 (3.3%)	-0.1 (-0.1%)	-0.1 (-0.2%)

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-18. Differences between EBC and ESO Scenarios in Mean Monthly Water Temperature (°F) in the Sacramento River at Bend Bridge

Month	Water-Year Type[a]	Scenario[b]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	1 (1.4%)	1 (3.2%)	1 (1.6%)	2 (3.4%)	0.03 (0.1%)	0 (0%)
	AN	1 (1.5%)	2 (3.5%)	1 (1.7%)	2 (3.6%)	0 (0%)	0 (0%)
	BN	1 (1.9%)	2 (3.9%)	1 (2%)	2 (4%)	0.04 (0.1%)	0 (0%)
	D	1 (1.9%)	2 (4.1%)	1 (2%)	2 (4.2%)	0 (0%)	-0.05 (-0.1%)
	C	1 (2.1%)	2 (4.9%)	1 (2.1%)	2 (4.8%)	-0.1 (-0.2%)	-0.03 (-0.1%)
	All	1 (1.7%)	2 (3.8%)	1 (1.8%)	2 (3.9%)	0 (0%)	0 (0%)
Feb	W	1 (1.8%)	2 (3.4%)	1 (1.8%)	2 (3.5%)	0 (0%)	0 (0%)
	AN	1 (1.8%)	2 (3.5%)	1 (1.9%)	2 (3.6%)	0.04 (0.1%)	0 (0%)
	BN	1 (1.9%)	2 (3.7%)	1 (2%)	2 (3.7%)	0 (0%)	0 (0%)
	D	1 (2.2%)	2 (4%)	1 (2.2%)	2 (4%)	0 (0%)	-0.04 (-0.1%)
	C	1 (2.2%)	2 (4.2%)	1 (2.2%)	2 (4.2%)	0 (0%)	-0.04 (-0.1%)
	All	1 (2%)	2 (3.7%)	1 (2%)	2 (3.7%)	0 (0%)	0 (0%)
Mar	W	1 (1.4%)	1 (3%)	1 (1.4%)	1 (3.1%)	0 (0%)	0 (0%)
	AN	1 (1.5%)	2 (3.2%)	1 (1.4%)	2 (3.2%)	0 (0%)	0.03 (0.1%)
	BN	1 (1.6%)	2 (3.6%)	1 (1.6%)	2 (3.6%)	0 (0%)	0.04 (0.1%)
	D	1 (1.5%)	2 (3.3%)	1 (1.6%)	2 (3.4%)	0 (0%)	-0.04 (-0.1%)
	C	1 (1.4%)	2 (3.2%)	1 (1.5%)	2 (3.3%)	-0.04 (-0.1%)	-0.2 (-0.4%)
	All	1 (1.5%)	2 (3.2%)	1 (1.5%)	2 (3.3%)	0 (0%)	-0.03 (-0.1%)
Apr	W	1 (1.6%)	2 (3.5%)	1 (1.6%)	2 (3.5%)	0 (0%)	0 (0%)
	AN	1 (1.5%)	2 (3.4%)	1 (1.5%)	2 (3.4%)	0 (0%)	-0.1 (-0.2%)
	BN	1 (1.8%)	2 (3.2%)	1 (1.5%)	2 (3%)	0 (0%)	-0.1 (-0.2%)
	D	1 (1.5%)	2 (3.2%)	1 (1.3%)	2 (2.9%)	-0.05 (-0.1%)	-0.2 (-0.4%)
	C	1 (1.8%)	2 (3.8%)	1 (1.5%)	2 (3.5%)	0 (0%)	-0.05 (-0.1%)
	All	1 (1.7%)	2 (3.4%)	1 (1.5%)	2 (3.3%)	0 (0%)	-0.1 (-0.1%)
May	W	2 (3%)	3 (5%)	2 (3%)	3 (4.9%)	0 (0%)	-0.3 (-0.5%)
	AN	1 (1.4%)	1 (2.2%)	1 (1.3%)	1 (2.1%)	-0.5 (-0.8%)	-1 (-0.9%)
	BN	1 (2.4%)	2 (3.3%)	1 (2.1%)	2 (3%)	-0.2 (-0.3%)	-0.4 (-0.6%)
	D	1 (2%)	1 (2.5%)	1 (1.7%)	1 (2.3%)	-0.3 (-0.5%)	-0.5 (-0.8%)
	C	1 (2%)	2 (3.6%)	1 (1.8%)	2 (3.5%)	0 (0%)	0.1 (0.1%)
	All	1 (2.3%)	2 (3.5%)	1 (2.1%)	2 (3.4%)	-0.2 (-0.3%)	-0.3 (-0.5%)
Jun	W	1 (1.4%)	1 (1.8%)	1 (1.4%)	1 (1.9%)	-0.1 (-0.2%)	-0.4 (-0.8%)
	AN	1 (1.1%)	1 (1.2%)	1 (1.3%)	1 (1.4%)	-0.2 (-0.3%)	-1 (-1.3%)
	BN	1 (1.2%)	1 (2.3%)	1 (1.2%)	1 (2.4%)	-0.2 (-0.4%)	-0.4 (-0.6%)
	D	1 (1.5%)	2 (3.3%)	1 (1.3%)	2 (3.1%)	-0.2 (-0.4%)	-0.2 (-0.3%)
	C	1 (1.4%)	2 (3.9%)	1 (1.5%)	2 (4%)	-0.2 (-0.3%)	0.2 (0.4%)
	All	1 (1.4%)	1 (2.5%)	1 (1.4%)	1 (2.5%)	-0.2 (-0.3%)	-0.3 (-0.5%)
Jul	W	0 (0.6%)	1 (1.9%)	0 (0.7%)	1 (2%)	-0.1 (-0.2%)	0.1 (0.2%)
	AN	1 (1.3%)	2 (3.1%)	1 (1.5%)	2 (3.2%)	0.1 (0.2%)	0.3 (0.5%)
	BN	1 (1.2%)	2 (3.7%)	1 (1.1%)	2 (3.7%)	-0.1 (-0.3%)	0.3 (0.6%)
	D	1 (2.1%)	3 (5.7%)	1 (1.9%)	3 (5.5%)	0.1 (0.3%)	1 (1.3%)
	C	2 (3.7%)	5 (8.6%)	2 (3%)	5 (7.8%)	-0.1 (-0.2%)	0 (0%)
	All	1 (1.6%)	2 (4.2%)	1 (1.5%)	2 (4.1%)	0 (0%)	0.3 (0.5%)

Month	Water-Year Type[a]	Scenario[b] EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Aug	W	1 (2.4%)	3 (4.9%)	1 (2.2%)	3 (4.7%)	0 (0%)	0.2 (0.3%)
	AN	1 (1.5%)	2 (4.2%)	1 (1.6%)	2 (4.3%)	0 (0%)	0.5 (0.8%)
	BN	1 (2.2%)	3 (5.6%)	1 (2.2%)	3 (5.6%)	-0.1 (-0.2%)	0.5 (0.8%)
	D	2 (3.8%)	4 (6.8%)	2 (3.7%)	4 (6.7%)	1 (1%)	1 (1.3%)
	C	3 (5.5%)	7 (12.3%)	3 (5.2%)	7 (12%)	-0.2 (-0.3%)	0.3 (0.5%)
	All	2 (3%)	4 (6.5%)	2 (2.9%)	4 (6.4%)	0.1 (0.1%)	0.4 (0.7%)
Sep	W	0 (0.5%)	1 (2.4%)	1 (2%)	2 (4%)	0.1 (0.2%)	0.1 (0.3%)
	AN	1 (0.9%)	2 (3%)	2 (2.7%)	3 (4.9%)	1 (1.4%)	1 (0.9%)
	BN	2 (3.4%)	4 (6.8%)	2 (3.3%)	4 (6.8%)	1 (1.2%)	1 (1.7%)
	D	3 (4.5%)	5 (7.9%)	2 (3.9%)	4 (7.3%)	0.2 (0.4%)	-0.3 (-0.5%)
	C	3 (4.4%)	5 (8.7%)	3 (4.5%)	5 (8.8%)	-0.1 (-0.2%)	0.1 (0.2%)
	All	1 (2.5%)	3 (5.5%)	2 (3.2%)	4 (6.1%)	0.3 (0.5%)	0.2 (0.4%)
Oct	W	1 (2.5%)	3 (5.5%)	1 (2%)	3 (5%)	0.1 (0.1%)	0.1 (0.3%)
	AN	1 (2.5%)	3 (5%)	1 (1.7%)	2 (4.3%)	0.1 (0.1%)	0.2 (0.3%)
	BN	1 (2.5%)	3 (5.8%)	1 (2%)	3 (5.3%)	0 (0%)	0.2 (0.4%)
	D	2 (2.7%)	3 (6.1%)	1 (2.4%)	3 (5.7%)	0.1 (0.1%)	0.2 (0.4%)
	C	1 (2.4%)	3 (6%)	1 (2.5%)	3 (6%)	-0.3 (-0.5%)	0 (0%)
	All	1 (2.6%)	3 (5.7%)	1 (2.1%)	3 (5.2%)	0 (0%)	0.2 (0.3%)
Nov	W	1 (1.8%)	2 (4.3%)	1 (1.2%)	2 (3.7%)	-0.2 (-0.4%)	-0.1 (-0.2%)
	AN	1 (1.6%)	2 (4.2%)	1 (1.6%)	2 (4.2%)	-0.3 (-0.6%)	-0.1 (-0.2%)
	BN	1 (1.6%)	2 (4.7%)	1 (1%)	2 (4.1%)	-0.4 (-0.7%)	-0.2 (-0.3%)
	D	1 (1.7%)	2 (4.3%)	1 (1.6%)	2 (4.2%)	-0.2 (-0.3%)	-0.1 (-0.2%)
	C	1 (1.8%)	2 (4.4%)	1 (1.7%)	2 (4.3%)	-0.1 (-0.3%)	-0.1 (-0.3%)
	All	1 (1.7%)	2 (4.4%)	1 (1.4%)	2 (4%)	-0.2 (-0.4%)	-0.1 (-0.2%)
Dec	W	1 (1.2%)	1 (2.4%)	1 (1.7%)	1 (3%)	0 (0%)	-0.1 (-0.1%)
	AN	1 (1.6%)	2 (3.9%)	1 (1.5%)	2 (3.8%)	-0.2 (-0.4%)	0 (0%)
	BN	1 (1.6%)	2 (4.3%)	1 (1.8%)	2 (4.5%)	-0.1 (-0.2%)	0.04 (0.1%)
	D	1 (1.6%)	2 (4.1%)	1 (1.8%)	2 (4.3%)	-0.1 (-0.1%)	-0.1 (-0.1%)
	C	1 (1.9%)	2 (4.2%)	1 (2.2%)	2 (4.5%)	0.04 (0.1%)	-0.05 (-0.1%)
	All	1 (1.5%)	2 (3.6%)	1 (1.8%)	2 (3.9%)	-0.1 (-0.1%)	-0.03 (-0.1%)

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-19. Mean Monthly Water Temperature (°F) in the Sacramento River at Keswick under ESO, HOS and LOS Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	46	46	46	47	46	47
	AN	46	46	47	48	47	48
	BN	47	47	47	48	47	48
	D	47	47	47	48	48	48
	C	47	47	47	48	47	48
	All	46	46	47	48	47	48
Feb	W	45	45	46	47	46	47
	AN	46	45	46	47	46	47
	BN	46	45	46	47	46	47
	D	46	46	47	48	47	48
	C	46	46	47	48	47	48
	All	46	46	46	47	46	47
Mar	W	46	46	47	47	47	47
	AN	46	46	47	48	47	48
	BN	47	47	47	48	48	48
	D	47	47	48	49	48	49
	C	48	48	49	50	49	49
	All	47	47	47	48	47	48
Apr	W	47	47	48	49	48	49
	AN	48	48	49	50	49	50
	BN	48	48	49	50	49	50
	D	48	48	49	50	49	50
	C	49	49	50	51	50	51
	All	48	48	49	50	49	50
May	W	49	49	49	50	50	50
	AN	49	49	50	51	50	50
	BN	49	49	50	51	50	51
	D	49	49	50	51	50	51
	C	51	51	52	53	52	53
	All	49	49	50	51	50	51
Jun	W	50	50	50	51	50	51
	AN	50	50	50	51	50	51
	BN	50	50	50	51	50	51
	D	50	50	51	52	51	52
	C	53	52	54	55	53	55
	All	50	50	51	52	51	52
Jul	W	51	51	51	52	51	52
	AN	51	51	51	52	51	52
	BN	51	51	51	52	51	52
	D	51	51	52	54	52	54
	C	54	55	57	59	56	59
	All	51	51	52	53	52	54

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Aug	W	52	52	53	54	53	54
	AN	52	52	53	54	53	55
	BN	52	52	53	54	53	55
	D	53	53	54	56	54	56
	C	57	57	60	64	60	64
	All	53	53	54	56	54	56
Sep	W	53	53	54	55	54	55
	AN	54	53	54	56	55	56
	BN	54	54	55	56	55	57
	D	55	55	57	59	57	59
	C	60	60	64	66	63	66
	All	55	55	56	58	56	58
Oct	W	54	54	55	57	55	57
	AN	54	54	55	57	55	57
	BN	54	55	56	57	55	58
	D	55	55	57	58	57	59
	C	56	56	58	60	58	60
	All	54	55	56	58	56	58
Nov	W	53	53	54	55	54	55
	AN	52	52	53	55	53	55
	BN	53	53	54	55	54	55
	D	53	53	54	56	54	56
	C	54	54	55	56	55	56
	All	53	53	54	55	54	55
Dec	W	49	49	50	50	50	50
	AN	49	49	50	51	50	51
	BN	50	50	51	52	51	52
	D	50	50	51	52	51	52
	C	51	51	51	52	51	52
	All	50	50	50	51	50	51

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-20. Mean Monthly Water Temperature (°F) by Water-Year Type in the Sacramento River at Bend Bridge under ESO, HOS and LOS

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	45	45	46	47	46	47
	AN	45	45	46	47	46	47
	BN	45	45	45	46	45	46
	D	45	45	46	47	46	47
	C	45	45	46	47	46	47
	All	45	45	46	47	46	47
Feb	W	46	46	47	47	47	47
	AN	46	46	47	48	47	48
	BN	46	46	47	48	47	48
	D	46	46	47	48	47	48
	C	47	47	48	49	48	49
	All	46	46	47	48	47	48
Mar	W	48	48	49	50	49	50
	AN	49	49	50	51	50	51
	BN	49	49	50	51	50	51
	D	50	50	51	52	51	52
	C	50	50	51	52	51	52
	All	49	49	50	51	50	51
Apr	W	51	51	52	53	52	53
	AN	53	53	54	55	54	55
	BN	53	53	54	55	54	55
	D	53	53	54	55	54	54
	C	52	53	53	54	53	54
	All	52	52	53	54	53	54
May	W	54	54	56	57	56	57
	AN	55	55	57	57	56	57
	BN	55	55	56	57	56	57
	D	55	55	56	56	56	56
	C	55	56	57	57	57	58
	All	55	55	56	57	56	57
Jun	W	56	56	57	57	56	57
	AN	55	55	56	57	56	56
	BN	55	55	56	57	56	56
	D	55	55	56	57	56	57
	C	57	57	58	59	57	59
	All	55	55	56	57	56	57
Jul	W	56	56	57	57	57	57
	AN	55	55	56	57	56	57
	BN	55	55	56	57	56	57
	D	56	56	57	58	57	59
	C	58	58	60	63	60	63
	All	56	56	57	58	57	58

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Aug	W	57	57	58	59	58	59
	AN	57	57	58	59	58	59
	BN	56	56	58	59	58	59
	D	57	57	59	60	59	61
	C	60	60	63	67	63	67
	All	57	57	59	60	59	61
Sep	W	57	56	57	58	57	58
	AN	58	57	58	59	58	60
	BN	58	58	59	60	60	62
	D	58	59	61	63	61	63
	C	62	62	65	67	64	67
	All	58	58	59	61	60	61
Oct	W	54	55	56	57	56	57
	AN	55	55	56	57	56	57
	BN	55	55	56	58	56	58
	D	55	55	57	58	57	59
	C	56	56	58	60	58	60
	All	55	55	56	58	56	58
Nov	W	51	51	52	53	51	53
	AN	51	51	52	53	51	53
	BN	51	51	52	53	52	53
	D	51	51	52	54	52	53
	C	52	52	53	54	53	54
	All	51	51	52	53	52	53
Dec	W	47	46	47	48	47	48
	AN	46	46	47	48	47	48
	BN	47	47	47	49	47	49
	D	46	46	47	48	47	48
	C	47	47	48	49	48	49
	All	47	46	47	48	47	48

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-21. Differences[a] between ESO Scenarios and HOS and LOS Scenarios in Mean Monthly Water Temperature (°F) in the Sacramento River at Keswick

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	0.04 (0.1%)	0.1 (0.1%)	0.04 (0.1%)	0.1 (0.3%)
	AN	0.1 (0.3%)	0 (0.1%)	0 (0%)	0.1 (0.1%)
	BN	0 (0%)	0.1 (0.3%)	0 (0%)	0.1 (0.2%)
	D	0.1 (0.3%)	0.2 (0.4%)	0 (0%)	0.1 (0.1%)
	C	0.4 (0.8%)	0.2 (0.4%)	0.2 (0.3%)	0.1 (0.1%)
	All	0.1 (0.2%)	0.1 (0.2%)	0.04 (0.1%)	0.1 (0.2%)
Feb	W	0 (0%)	0 (0%)	0 (0%)	0.1 (0.2%)
	AN	0 (0%)	0 (0%)	0.03 (0.1%)	0.1 (0.2%)
	BN	0 (0%)	0.1 (0.2%)	0 (0%)	0.1 (0.2%)
	D	0.1 (0.2%)	0.1 (0.2%)	0 (0%)	0.1 (0.2%)
	C	0.2 (0.4%)	0.1 (0.3%)	-0.1 (-0.1%)	0.1 (0.1%)
	All	0.05 (0.1%)	0.1 (0.1%)	0 (0%)	0.1 (0.2%)
Mar	W	-0.04 (-0.1%)	0 (0%)	0 (0%)	0.1 (0.2%)
	AN	-0.1 (-0.1%)	0 (0%)	0 (0%)	0.1 (0.1%)
	BN	-0.1 (-0.1%)	0.1 (0.2%)	-0.04 (-0.1%)	0.1 (0.1%)
	D	0 (0%)	0.05 (0.1%)	-0.02 (-0.1%)	0.04 (0.1%)
	C	0.1 (0.2%)	0.2 (0.3%)	0 (0%)	0.1 (0.1%)
	All	0 (0%)	0.1 (0.1%)	0 (0%)	0.1 (0.1%)
Apr	W	-0.1 (-0.1%)	0 (-0.1%)	0 (0%)	0.1 (0.2%)
	AN	-0.1 (-0.2%)	0 (0%)	0 (0%)	0.1 (0.1%)
	BN	0 (0%)	0.1 (0.2%)	0.03 (0.1%)	0.03 (0.1%)
	D	0.1 (0.2%)	0.1 (0.2%)	-0.04 (-0.1%)	0.05 (0.1%)
	C	0.1 (0.2%)	-0.1 (-0.2%)	0 (0%)	-0.1 (-0.1%)
	All	0 (0%)	0 (0%)	0 (0%)	0.05 (0.1%)
May	W	0 (0%)	0.1 (0.1%)	0 (0%)	0.05 (0.1%)
	AN	0 (0%)	0.1 (0.1%)	0.04 (0.1%)	0.2 (0.4%)
	BN	0.03 (0.1%)	0.2 (0.3%)	-0.1 (-0.1%)	0 (0%)
	D	0.1 (0.2%)	0.1 (0.2%)	-0.1 (-0.2%)	-0.1 (-0.2%)
	C	-0.1 (-0.2%)	-0.4 (-0.7%)	-0.03 (-0.1%)	-0.1 (-0.2%)
	All	0 (0%)	0.03 (0.1%)	-0.03 (-0.1%)	0 (0%)
Jun	W	0 (0%)	0.1 (0.2%)	0 (0%)	0 (0%)
	AN	0.1 (0.2%)	0.2 (0.4%)	0.04 (0.1%)	0.1 (0.3%)
	BN	0.05 (0.1%)	0.03 (0.1%)	0 (0%)	0 (0%)
	D	-0.1 (-0.2%)	-0.05 (-0.1%)	-0.2 (-0.5%)	-0.2 (-0.3%)
	C	-0.2 (-0.4%)	-0.2 (-0.4%)	-0.1 (-0.2%)	0.1 (0.2%)
	All	-0.03 (-0.1%)	0 (0%)	-0.1 (-0.1%)	0 (0%)
Jul	W	-0.1 (-0.1%)	-0.1 (-0.2%)	0 (0%)	0.05 (0.1%)
	AN	-0.2 (-0.5%)	-0.3 (-0.6%)	0.1 (0.2%)	0.05 (0.1%)
	BN	-0.1 (-0.2%)	-0.3 (-0.5%)	0.1 (0.2%)	0.2 (0.3%)
	D	-0.1 (-0.1%)	-1 (-1%)	-0.2 (-0.3%)	-0.2 (-0.5%)
	C	-1 (-1.5%)	-1 (-1.7%)	0.1 (0.1%)	-0.2 (-0.4%)
	All	-0.2 (-0.4%)	-0.4 (-0.7%)	0 (0%)	-0.04 (-0.1%)

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	-0.1 (-0.2%)	-0.2 (-0.4%)	0 (0%)	0.1 (0.2%)
	AN	-0.2 (-0.5%)	-1 (-0.9%)	0.03 (0.1%)	0 (0%)
	BN	-0.2 (-0.5%)	-1 (-1.1%)	0.1 (0.2%)	0.1 (0.1%)
	D	-0.5 (-0.8%)	-1 (-1%)	0.3 (0.5%)	-0.1 (-0.2%)
	C	-2 (-3%)	-1 (-1.8%)	0.2 (0.3%)	-0.2 (-0.3%)
	All	-0.5 (-0.9%)	-1 (-1%)	0.1 (0.2%)	0 (0%)
Sep	W	-0.1 (-0.1%)	-0.2 (-0.3%)	0.3 (0.6%)	0.5 (0.8%)
	AN	-0.1 (-0.3%)	-0.4 (-0.7%)	0.03 (0.1%)	0.3 (0.6%)
	BN	-0.1 (-0.3%)	-1 (-1.3%)	-0.4 (-0.7%)	-0.4 (-0.7%)
	D	-0.4 (-0.8%)	-0.4 (-0.7%)	-0.03 (-0.1%)	-0.4 (-0.7%)
	C	-2 (-3.3%)	-1 (-1.3%)	-0.3 (-0.5%)	-0.4 (-0.6%)
	All	-0.5 (-0.8%)	-0.5 (-0.8%)	0 (0%)	0 (0%)
Oct	W	-0.1 (-0.1%)	0 (0%)	-0.3 (-0.5%)	-1 (-1.2%)
	AN	-0.03 (-0.1%)	-0.1 (-0.2%)	-0.3 (-0.6%)	-1 (-1.1%)
	BN	-0.1 (-0.2%)	-0.2 (-0.4%)	-0.1 (-0.2%)	-1 (-1.1%)
	D	-0.3 (-0.6%)	-0.3 (-0.5%)	-0.2 (-0.3%)	-1 (-1.1%)
	C	-1 (-1.5%)	-0.4 (-0.7%)	-0.1 (-0.2%)	-0.3 (-0.5%)
	All	-0.2 (-0.4%)	-0.2 (-0.3%)	-0.2 (-0.4%)	-1 (-1%)
Nov	W	0 (0%)	-0.1 (-0.1%)	-0.1 (-0.2%)	-0.3 (-0.6%)
	AN	0.1 (0.1%)	-0.1 (-0.1%)	-0.2 (-0.3%)	-0.3 (-0.6%)
	BN	0 (0%)	-0.1 (-0.3%)	0.03 (0.1%)	-0.4 (-0.7%)
	D	0 (0%)	0 (0%)	-0.1 (-0.2%)	-0.2 (-0.4%)
	C	-0.2 (-0.3%)	-0.1 (-0.2%)	0 (0%)	-0.04 (-0.1%)
	All	0 (0%)	-0.1 (-0.1%)	-0.1 (-0.1%)	-0.3 (-0.5%)
Dec	W	0.1 (0.2%)	0.1 (0.1%)	0.1 (0.1%)	0.1 (0.2%)
	AN	0.2 (0.3%)	0.1 (0.2%)	-0.1 (-0.3%)	-0.2 (-0.5%)
	BN	0.03 (0.1%)	0.03 (0.1%)	0.03 (0.1%)	-0.05 (-0.1%)
	D	0.1 (0.1%)	0.1 (0.2%)	-0.1 (-0.1%)	-0.04 (-0.1%)
	C	0.2 (0.3%)	0.1 (0.2%)	0.05 (0.1%)	0 (0%)
	All	0.1 (0.2%)	0.1 (0.2%)	0 (0%)	0 (0%)

[a] Positive values indicate higher temperatures under HOS or LOS than under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-22. Differences[a] between ESO Scenarios and HOS and LOS Scenarios in Mean Monthly Water Temperature (°F) in the Sacramento River at Bend Bridge

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	0 (0%)	0 (0%)	0.04 (0.1%)	0.1 (0.2%)
	AN	0.05 (0.1%)	0 (0%)	0 (0%)	0.2 (0.3%)
	BN	0 (0%)	0.1 (0.1%)	0 (0%)	0.1 (0.2%)
	D	0.1 (0.1%)	0 (0%)	0.1 (0.1%)	0.1 (0.2%)
	C	0.2 (0.4%)	-0.1 (-0.2%)	0.3 (0.6%)	0.1 (0.1%)
	All	0.1 (0.1%)	0 (0%)	0.1 (0.1%)	0.1 (0.2%)
Feb	W	0 (0%)	0 (0%)	0 (0%)	0.04 (0.1%)
	AN	0 (0%)	0 (0%)	0 (0%)	0.1 (0.1%)
	BN	0 (0%)	0.03 (0.1%)	0 (0%)	0.03 (0.1%)
	D	0.1 (0.1%)	0 (0%)	0.03 (0.1%)	0.03 (0.1%)
	C	0.1 (0.2%)	0.03 (0.1%)	0 (0%)	0 (0%)
	All	0.03 (0.1%)	0 (0%)	0 (0%)	0.04 (0.1%)
Mar	W	0 (0%)	0 (0%)	0 (0%)	0.04 (0.1%)
	AN	0 (0%)	0.04 (0.1%)	0 (0%)	0 (0%)
	BN	0 (0%)	0.1 (0.1%)	-0.1 (-0.2%)	-0.1 (-0.2%)
	D	0 (0%)	0.03 (0.1%)	0 (0%)	0 (0%)
	C	0.1 (0.2%)	0.1 (0.2%)	0 (0%)	0 (0%)
	All	0 (0%)	0.04 (0.1%)	0 (0%)	0 (0%)
Apr	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	-0.05 (-0.1%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0.2 (0.4%)	-0.1 (-0.2%)	0.04 (0.1%)
	D	0.1 (0.2%)	0.2 (0.4%)	-0.04 (-0.1%)	0.1 (0.1%)
	C	0.1 (0.2%)	-0.1 (-0.1%)	0 (0%)	-0.04 (-0.1%)
	All	0 (0%)	0.1 (0.1%)	-0.03 (-0.1%)	0 (0%)
May	W	0 (0%)	0.1 (0.2%)	0 (0%)	0 (0%)
	AN	0.1 (0.2%)	0.3 (0.5%)	0 (0%)	0.2 (0.4%)
	BN	0.2 (0.3%)	0.5 (0.8%)	-0.2 (-0.3%)	-0.1 (-0.1%)
	D	0.1 (0.3%)	0.4 (0.7%)	-0.1 (-0.2%)	-0.1 (-0.2%)
	C	-0.1 (-0.1%)	-0.2 (-0.3%)	-0.1 (-0.2%)	-0.1 (-0.1%)
	All	0.1 (0.1%)	0.2 (0.4%)	-0.1 (-0.1%)	0 (0%)
Jun	W	0.1 (0.1%)	0.3 (0.6%)	0 (0%)	-0.04 (-0.1%)
	AN	0.4 (0.6%)	1 (1.4%)	0 (0%)	0.1 (0.2%)
	BN	0.2 (0.4%)	0.3 (0.6%)	0 (0%)	-0.1 (-0.2%)
	D	0.1 (0.2%)	0.2 (0.4%)	-0.1 (-0.2%)	-0.1 (-0.2%)
	C	-0.1 (-0.2%)	-0.04 (-0.1%)	-0.1 (-0.1%)	0.1 (0.2%)
	All	0.1 (0.2%)	0.3 (0.6%)	-0.04 (-0.1%)	0 (0%)
Jul	W	0 (0%)	-0.04 (-0.1%)	0 (0%)	0 (0%)
	AN	-0.2 (-0.4%)	-0.2 (-0.3%)	0.1 (0.1%)	0 (0%)
	BN	0.1 (0.1%)	-0.2 (-0.3%)	0.2 (0.3%)	0.1 (0.2%)
	D	0 (0%)	-1 (-1%)	-0.2 (-0.3%)	-0.3 (-0.5%)
	C	-0.4 (-0.7%)	-1 (-1.4%)	0.1 (0.2%)	-0.1 (-0.2%)
	All	-0.1 (-0.1%)	-0.3 (-0.6%)	0 (0%)	-0.1 (-0.1%)

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	-0.1 (-0.2%)	-0.3 (-0.5%)	0 (0%)	0.1 (0.1%)
	AN	-0.2 (-0.4%)	-1 (-1.1%)	0.1 (0.1%)	-0.04 (-0.1%)
	BN	-0.1 (-0.3%)	-1 (-1%)	0.2 (0.3%)	0.1 (0.2%)
	D	-0.8 (-1.4%)	-1 (-1.4%)	0.2 (0.3%)	-0.1 (-0.2%)
	C	-1.3 (-2.1%)	-1 (-1.8%)	0.2 (0.3%)	-0.3 (-0.5%)
	All	-0.5 (-0.8%)	-1 (-1.1%)	0.1 (0.2%)	-0.03 (-0.1%)
Sep	W	-0.1 (-0.2%)	-0.2 (-0.4%)	1 (2.1%)	2 (3.5%)
	AN	-0.4 (-0.7%)	-1 (-0.8%)	0.3 (0.5%)	1 (2%)
	BN	0 (0%)	-1 (-1.1%)	-1 (-1.2%)	-1 (-1.1%)
	D	-0.4 (-0.7%)	-0.5 (-0.7%)	-0.3 (-0.6%)	-0.4 (-0.6%)
	C	-1 (-2%)	-1 (-1%)	-0.3 (-0.4%)	-0.3 (-0.4%)
	All	-0.4 (-0.6%)	-0.5 (-0.7%)	0.2 (0.3%)	1 (0.9%)
Oct	W	-0.05 (-0.1%)	0 (0%)	-0.2 (-0.3%)	-0.4 (-0.7%)
	AN	0 (0%)	-0.1 (-0.1%)	-0.2 (-0.4%)	-0.4 (-0.6%)
	BN	-0.1 (-0.2%)	-0.2 (-0.4%)	-0.1 (-0.2%)	-0.4 (-0.7%)
	D	-0.2 (-0.4%)	-0.3 (-0.4%)	-0.1 (-0.1%)	-0.4 (-0.6%)
	C	-1 (-1%)	-0.3 (-0.5%)	-0.1 (-0.1%)	-0.2 (-0.3%)
	All	-0.2 (-0.3%)	-0.2 (-0.3%)	-0.1 (-0.2%)	-0.4 (-0.6%)
Nov	W	0 (0%)	0 (0%)	-0.1 (-0.2%)	-0.4 (-0.7%)
	AN	0.1 (0.3%)	0.04 (0.1%)	-0.2 (-0.4%)	-0.3 (-0.6%)
	BN	0.05 (0.1%)	-0.1 (-0.2%)	-0.1 (-0.1%)	-0.4 (-0.7%)
	D	-0.03 (-0.1%)	0 (0%)	-0.1 (-0.1%)	-0.2 (-0.4%)
	C	-0.2 (-0.3%)	-0.1 (-0.2%)	-0.1 (-0.1%)	-0.1 (-0.2%)
	All	0 (0%)	-0.03 (-0.1%)	-0.1 (-0.2%)	-0.3 (-0.5%)
Dec	W	0.1 (0.2%)	0.1 (0.1%)	0.2 (0.4%)	0.2 (0.5%)
	AN	0.1 (0.2%)	0.1 (0.1%)	-0.1 (-0.2%)	-0.1 (-0.2%)
	BN	0.03 (0.1%)	-0.1 (-0.2%)	0.03 (0.1%)	0.04 (0.1%)
	D	0 (0%)	-0.1 (-0.1%)	0.1 (0.2%)	0.1 (0.2%)
	C	0 (0%)	0.04 (0.1%)	0.05 (0.1%)	0.1 (0.2%)
	All	0.04 (0.1%)	0 (0%)	0.1 (0.2%)	0.1 (0.2%)

[a] Positive values indicate higher temperatures under HOS or LOS than under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Coldwater pool availability is determined, to a large extent, by the volume of water in reservoir storage. The volume of reservoir storage in the spring (May) and fall (September) has been used here as an indicator of changes in reservoir storage between EBC and ESO scenarios (Table 5C.5.2-23). Frequency of exceedance plots for Shasta Reservoir storage in May and September are shown in Figure 5C.5.2-26 and Figure 5C.5.2-27, respectively. Table 5C.5.2-24 presents differences in May and September storage between EBC2 and ESO scenarios. These results indicate that Shasta Reservoir storage and, therefore, coldwater pool volume would be comparable (i.e., not meaningfully different) between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. Therefore, BDCP implementation is not expected to have a substantial effect on coldwater pool availability and the ability to meet downstream water temperature conditions for steelhead in the Sacramento River downstream of Keswick Dam.

May and September Shasta storage under ESO, HOS, and LOS scenarios are presented in (Table 5C.5.2-25) and differences between the ESO scenario and HOS and LOS scenarios are presented in Table 5C.5.2-26. These results indicate that there would be very few differences in Shasta storage between the ESO scenario and HOS and LOS scenarios. All meaningful (>5%) differences in Shasta storage would be the result of higher reservoir storage under either HOS or LOS.

Table 5C.5.2-23. May and September Water Storage Volume (Thousand Acre-Feet) in Shasta Reservoir for EBC and ESO Scenarios

Water-Year Type	Scenario[a]					
	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
May						
Wet	4,470	4,473	4,457	4,436	4,457	4,411
Above Normal	4,474	4,477	4,448	4,388	4,402	4,318
Below Normal	4,110	4,101	4,014	3,912	4,027	3,780
Dry	3,778	3,726	3,575	3,334	3,556	3,228
Critical	2,443	2,398	2,146	1,859	2,238	1,821
All	3,960	3,942	3,848	3,720	3,853	3,651
September						
Wet	3,317	3,137	3,020	2,805	3,009	2,712
Above Normal	3,197	3,034	2,834	2,582	2,834	2,520
Below Normal	2,872	2,857	2,705	2,518	2,642	2,429
Dry	2,455	2,407	2,253	1,944	2,284	1,920
Critical	1,187	1,182	990	805	1,055	795
All	2,723	2,628	2,474	2,242	2,476	2,181

[a] See Table 5C.0-1 for definitions of the scenarios.

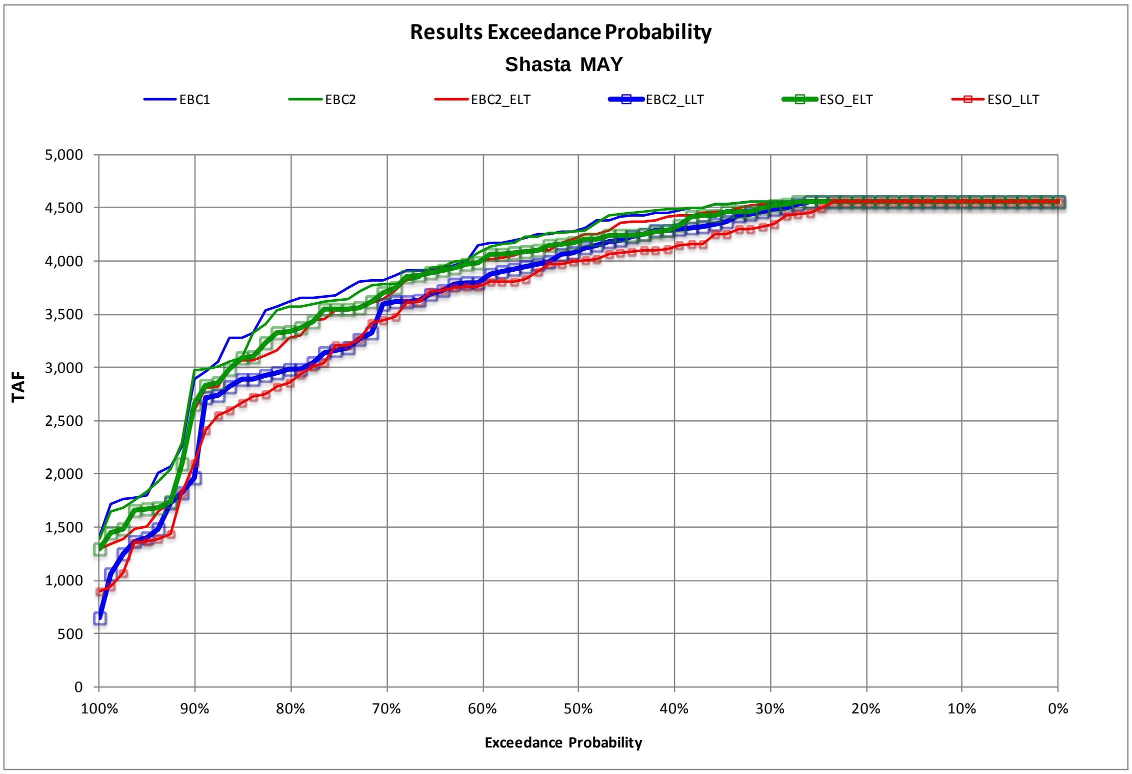


Figure 5C.5.2-26. Probability of Exceedance Plot for Model Scenarios of Shasta Reservoir Water Storage Volume, May

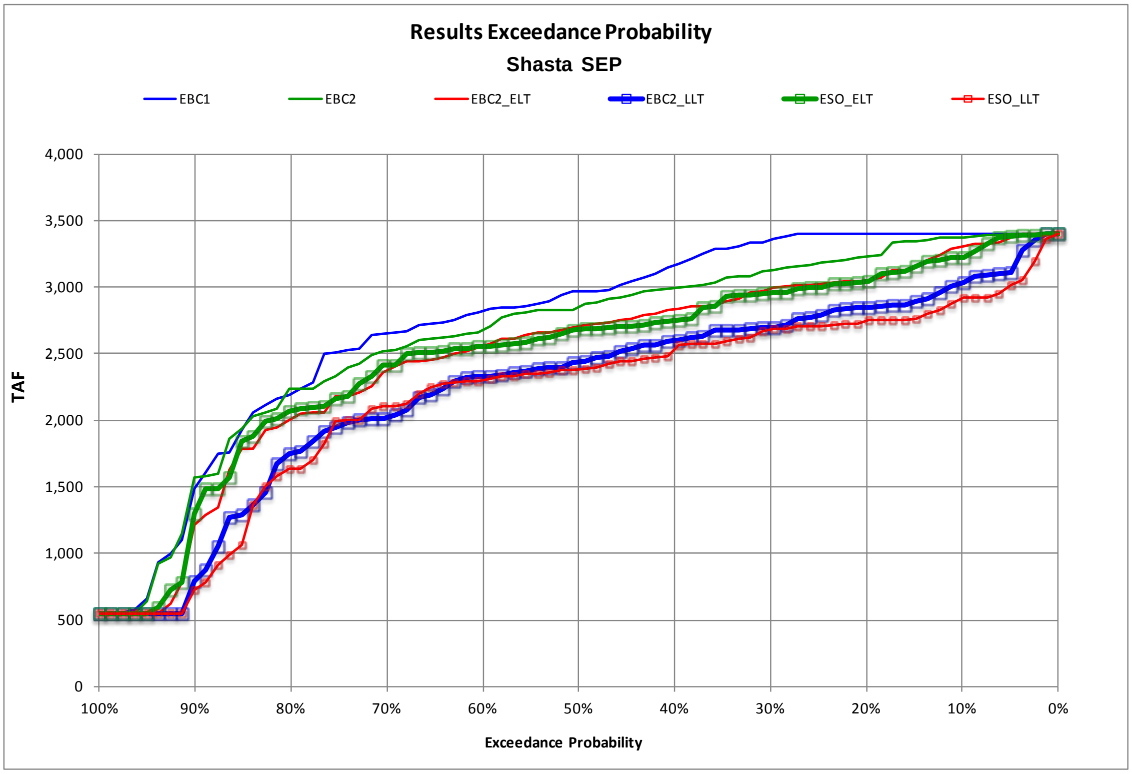


Figure 5C.5.2-27. Probability of Exceedance Plot for Model Scenarios of Shasta Reservoir Water Storage Volume, September

Table 5C.5.2-24. Differences[a] between EBC and ESO Scenarios in May and September Water Storage Volume (Thousand Acre-Feet) in Shasta Reservoir

Water-Year Type	Scenario[b]	
	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
May		
Wet	0 (0%)	-25 (-0.6%)
Above Normal	-46 (-1%)	-70 (-1.6%)
Below Normal	13 (0.3%)	-131 (-3.4%)
Dry	-19 (-0.5%)	-106 (-3.2%)
Critical	92 (4.3%)	-38 (-2.1%)
All	5 (0.1%)	-69 (-1.9%)
September		
Wet	-11 (-0.4%)	-93 (-3.3%)
Above Normal	0 (0%)	-62 (-2.4%)
Below Normal	-63 (-2.3%)	-88 (-3.5%)
Dry	31 (1.4%)	-23 (-1.2%)
Critical	65 (6.6%)	-10 (-1.2%)
All	2 (0.1%)	-60 (-2.7%)

[a] Positive values indicate greater storage volume under ESO than under EBC.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-25. May and September Water Storage Volume (Thousand Acre-Feet) in Shasta Reservoir under ESO, HOS, and LOS Scenarios

Water-Year Type	Scenario[a]					
	ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
May						
Wet	4,457	4,411	4,460	4,426	4,457	4,410
Above Normal	4,402	4,318	4,422	4,335	4,400	4,325
Below Normal	4,027	3,780	4,043	3,929	3,992	3,814
Dry	3,556	3,228	3,637	3,344	3,577	3,342
Critical	2,238	1,821	2,390	1,969	2,212	1,854
All	3,853	3,651	3,899	3,731	3,848	3,687
September						
Wet	3,009	2,712	3,015	2,722	3,219	3,043
Above Normal	2,834	2,520	2,827	2,563	2,894	2,691
Below Normal	2,642	2,429	2,729	2,555	2,591	2,418
Dry	2,284	1,920	2,311	1,991	2,253	1,994
Critical	1,055	795	1,225	850	1,063	805
All	2,476	2,181	2,522	2,236	2,537	2,327

[a] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-26. Differences[a] between ESO Scenarios and HOS and LOS Scenarios in May and September Water Storage Volume (Thousand Acre-Feet) in Shasta Reservoir

Water-Year Type	Scenarios[b]			
	ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
May				
Wet	3 (0.1%)	15 (0.4%)	0 (0%)	-1 (-0.02%)
Above Normal	20 (0.4%)	17 (0.4%)	-2 (0%)	7 (0.2%)
Below Normal	16 (0.4%)	149 (3.9%)	-35 (-0.9%)	34 (0.9%)
Dry	81 (2.3%)	117 (3.6%)	21 (0.6%)	115 (3.6%)
Critical	152 (6.8%)	148 (8.1%)	-26 (-1.2%)	32 (1.8%)
All	47 (1.2%)	80 (2.2%)	-5 (-0.1%)	37 (1%)
September				
Wet	6 (0.2%)	10 (0.4%)	210 (7%)	331 (12.2%)
Above Normal	-7 (-0.2%)	43 (1.7%)	60 (2.1%)	170 (6.8%)
Below Normal	87 (3.3%)	125 (5.2%)	-51 (-1.9%)	-11 (-0.4%)
Dry	27 (1.2%)	71 (3.7%)	-31 (-1.4%)	74 (3.8%)
Critical	170 (16.1%)	55 (6.9%)	7 (0.7%)	10 (1.3%)
All	46 (1.9%)	55 (2.5%)	61 (2.5%)	146 (6.7%)

[a] Positive values indicate greater storage volume under HOS or LOS than under ESO.
[b] See Table 5C.0-1 for definitions of the scenarios.

Water temperature criteria for various life stages of salmonids in the Central Valley have been developed by the National Marine Fisheries Service (NMFS) (2009, in prep.) and are used this effects analysis. The general water temperature criteria for Central Valley salmonids are shown in Table 5C.5.2-27. For purposes of this effects analysis, water temperature criteria of 56°F or less is identified as suitable for steelhead spawning and egg incubation and 65°F or less is identified as suitable for juvenile steelhead rearing and for juvenile and adult migration.

Table 5C.5.2-27. Summary of Water Temperature Criteria for Central Valley Salmonids

River	Target Species and Life Stage	Temperature Target Point	Miles below Dam	Date	Temperature Target (°F)	Comment
Sacramento River	Winter-run egg incubation	Ball's Ferry	26	4/15–9/30	56	Location depends on coldwater availability
	Winter-run egg incubation	Bend Bridge	44	4/15–9/30	56	Location depends on coldwater availability
	Spring-run incubation and winter-run rearing	Ball's Ferry	26	10/1–10/31	60	Location depends on coldwater availability
	Spring-run incubation and winter-run rearing	Bend Bridge	44	10/1–10/31	60	Location depends on coldwater availability
Clear Creek	Spring-run prespawn and steelhead rearing	Igo	7.5	6/1–9/15	60	
	Spring-run spawning and steelhead rearing	Igo	7.5	9/15–10/31	56	
American River	Steelhead rearing	Watt Avenue	13.4	5/15–10/31	65	Target based on yearly plan

River	Target Species and Life Stage	Temperature Target Point	Miles below Dam	Date	Temperature Target (°F)	Comment
Stanislaus River	Steelhead adult migration	Orange Blossom Bridge	11	10/1–12/31	56	[a]
	Steelhead smoltification	Knights Ferry	5.5	1/1–5/31	52	[a]
	Steelhead smoltification	Orange Blossom Bridge	11	1/1–5/31	57	[a]
	Steelhead spawning and incubation	Orange Blossom Bridge	11	1/1–5/31	55	[a]
	Steelhead rearing	Orange Blossom Bridge	11	6/1–9/30	65	[a]

Source: National Marine Fisheries Service 2009.
[a] Stanislaus temperatures are based on a 7-day average daily maximum temperature per the 2009 NMFS OCAP BiOp.

Given the results presented here, it was concluded that there would be no water temperature-related effects of the ESO on steelhead spawning and egg incubation in the Sacramento River. Likewise, there would be no water temperature-related effects of the HOS and LOS scenarios on steelhead spawning and egg incubation in the Sacramento River.

The SacEFT analytical framework assessed suitability of egg incubation habitat for salmonids in the Sacramento River, which is characterized as “Egg-To-Fry Thermal Mortality” in SacEFT documentation (see Attachment 5C.B). Results of SacEFT analyses showed that water temperatures for steelhead egg incubation were classified as good in 100% of years for all model scenarios (Table 5C.5.2-14). These results reflect, in part, the fact that steelhead spawn and their eggs incubate during the winter and early spring when water temperatures in the Sacramento River are naturally cool. It should be noted that steelhead thermal mortality estimates rely on Chinook salmon relationships and, according to SacEFT documentation, “the wide range in mortality in empirical studies makes it very difficult to predict steelhead egg mortality with any precision” (Attachment 5C.B, *Sacramento River Ecological Flows Tool (SacEFT): Record of Design (v.2.00)*).

Redd Dewatering

The SacEFT predicts that redd dewatering conditions would be classified as good (reduced risk of redd dewatering) in 57% of years for EBC1, 55% of the years for EBC2, and 56% of the years for both EBC2_ELT and ESO_ELT (Table 5C.5.2-14). These results suggest that there would be no substantive effect of the ESO in the early long-term period to the risk of redd dewatering. The model predicts that redd dewatering risk would be good in 54% of the years for EBC2_LLT and 57% of the years for ESO_LLT. The 3% predicted increase in the percentage of years with good dewatering risk under ESO_LLT relative to EBC2_LLT indicates that there would be a negligible effect of the ESO to steelhead egg survival steelhead in the late long-term period.

5C.5.2.1.1.2 Fry and Juvenile Rearing

Rearing Habitat

Juvenile steelhead rear within the Sacramento River and its tributaries throughout the year. Changes in instream flows within the juvenile steelhead rearing areas could affect the value and availability of rearing habitat through changes in physical characteristics of wetted channel width, water depth, and water velocities. Instream flow studies have been conducted (U.S. Fish and Wildlife Service 2003; Gard 2005) that provide information on the relationship between river flow and juvenile steelhead rearing habitat (referred to as weighted usable area, WUA). The WUA estimates include results of hydraulic simulations of how variables such as water depth and velocity change in response to flow, as well as information on habitat preferences and habitat suitability indices (HSI) for each fish species and life stage of interest.

The two primary potential effects of BDCP operations on habitat conditions for fry and juvenile steelhead rearing on the mainstem Sacramento River relate to changes in either instream flows or seasonal water temperatures released from Shasta and Keswick dams. Juvenile steelhead rearing occurs throughout the year as juveniles inhabit upstream areas for a period of 1 to 2 years before migrating downstream to the ocean. Predicted instream flows within the reach where the majority of steelhead spawning and juvenile rearing occurs (Keswick Dam to upstream of RBDD) are presented in Table 5C.5.2-1 and Table 5C.5.2-3, and differences between pairs of model scenarios are presented in Table 5C.5.2-2 and Table 5C.5.2-4. Monthly frequency of exceedance plots for Sacramento River flows at Keswick and upstream of RBDD for all months are presented in Figure 5C.5.2-1 through Figure 5C.5.2-12 and in Figure 5C.5.2-13 through Figure 5C.5.2-24, respectively.

For each month and water-year type, flows under ESO_ELT and ESO_LLT are predicted to be greater than or similar to those under EBC2 ELT and EBC2_LLT, respectively, indicating that the effects of the ESO on Sacramento River flows independent of climate change would be small. One exception is November, during which average flows would be 5% to 23% lower in the ESO relative to EBC2 depending on location and water-year type. This decrease is not likely to affect the steelhead population, however, because the frequency of exceeding minimum flows thresholds of 4,000 cfs to keep side channels wet would not differ between EBC2 and ESO in both the early and late long-term periods (Table 5C.5.2-10 and Table 5C.5.2-11). Flows under HOS and LOS scenarios would be largely similar to those under ESO throughout the year with some exceptions. In addition to those flow differences discussed above, flows under LOS_ELT and LOS_LLT would be 12% to 46% lower than flows under ESO_ELT and ESO_LLT, respectively, during September in wet and above normal water years, resulting in a 25% to 45% reduction in flows under LOS_ELT and LOS_LLT. However, an evaluation of the exceedance of the 4,000 cfs minimum flow threshold required to keep side channels flowing in each of these water years during September indicates that there would be no more than a 5% reduction in the exceedance above the threshold. Therefore, the reduction in flows during wet and above normal water years during September would not affect steelhead rearing habitat. Second, flows would be up to 17% lower under LOS_LLT than ESO_LLT in all water-year types during November at both locations in the Sacramento River. This would increase the reduction in flows from 5% to 18% lower in the ESO_LLT relative to the EBC2_LLT to 9% to 36% lower in the LOS_LLT relative to the EBC2_LLT depending on water-year type. An evaluation of the exceedance of the 4,000 cfs minimum flow threshold required to keep side channels flowing during November indicates that the frequency of exceedance above the threshold would be reduced under the LOS scenario relative to the ESO scenario by up to 21% depending on water-year type. Third, there would be reductions in Keswick flows under HOS_LLT relative to ESO_LLT during May and June.

However, despite these reductions, flows under ESO_LLT would be similar to flows under EBC2_LLT during May and June (see Table 5C.5.2-1). Because these flow reductions in the Sacramento River under HOS and LOS scenarios would be limited to some months and water years and their magnitude would vary by water-year type, they are not expected to affect steelhead at a population level.

Because juvenile steelhead rear within the Sacramento River year-round, the lowest predicted monthly instream flow from CALSIM was used as one indicator of habitat conditions for juvenile rearing (Table 5C.5.2-28, Table 5C.5.2-29). Results of this analysis predict that minimum flows upstream of RBDD would be mostly similar between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. The 14% reduction in the late long-term period during wet years would not affect steelhead because flows would still be above the 4,000 cfs threshold to keep side channels flowing. The 10% decrease in critical years during the early long-term period would cause a small reduction in the amount of rearing habitat available to steelhead juveniles in these years. The effect of climate change, which can be predicted by comparing minimum mean flows under EBC2 and EBC2_ELT, would be much larger than the decrease due to the ESO in the early long-term.

Table 5C.5.2-28. Minimum Mean Monthly Flow (cfs) in the Sacramento River upstream of Red Bluff Diversion Dam during the Year-Round Juvenile Steelhead Rearing Period under EBC and ESO Scenarios

Water-Year Type	Scenario[a]					
	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Wet	5,310	5,146	5,182	5,444	5,377	4,696
Above Normal	4,776	4,244	4,006	4,033	4,005	3,995
Below Normal	3,403	3,453	3,336	3,336	3,336	3,997
Dry	4,460	4,263	3,357	3,457	3,350	3,417
Critical	3,967	3,936	3,231	3,183	2,897	3,191

[a] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-29. Differences[a] between EBC and ESO Scenarios in Minimum Mean Monthly Flows (cfs) in the Sacramento River Upstream of Red Bluff Diversion Dam during the Year-Round Juvenile Steelhead Rearing Period

Water-Year Type	Scenarios[b]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Wet	67 (1%)	-614 (-12%)	231 (4%)	-450 (-9%)	195 (4%)	-748 (-14%)
Above Normal	-770 (-16%)	-780 (-16%)	-239 (-6%)	-249 (-6%)	0 (0%)	-38 (-1%)
Below Normal	-67 (-2%)	594 (17%)	-117 (-3%)	544 (16%)	0 (0%)	661 (20%)
Dry	-1,109 (-25%)	-1,042 (-23%)	-912 (-21%)	-845 (-20%)	-6 (0%)	-40 (-1%)
Critical	-1,070 (-27%)	-776 (-20%)	-1,039 (-26%)	-745 (-19%)	-334 (-10%)	8 (0%)

[a] Positive values indicate greater monthly flows under ESO than under EBC.
[b] See Table 5C.0-1 for definitions of the scenarios.

SacEFT classifies juvenile rearing weighted usable area (WUA) as good in 41% of years for EBC1 and 43% of the years for EBC1 and EBC2 (Table 5C.5.2-14). Rearing WUA was classified as good in 45% of the years for EBC2_ELT, which decreased to 42% of the years under ESO_ELT, a decrease of 3%. Rearing WUA was classified as worrisome in 38% of the years for EBC2_ELT, which increased to

41% of the years under ESO_ELT, an increase of 3%. Rearing WUA for juvenile rearing were classified as good in 45% of the years under EBC2_LLT which decreased to 35% of the years for ESO_LLT, a decrease of 10%. Rearing WUA for juvenile rearing were classified as worrisome in 43% of the years under EBC2_LLT which increased to 51% of the years for ESO_LLT, an increase of 8%. The decrease in the percentage of years in which juvenile rearing WUA was classified as good and increase in the percentage of years in which juvenile rearing WUA was classified as worrisome for ESO_ELT and ESO_LLT suggests that there would be a small decrease in suitable habitat availability to steelhead in the Sacramento River.

Flow fluctuations have the potential to strand juvenile steelhead in backwater areas and along channel margins when flow is rapidly reduced. Results of SacEFT showed that the risk of juvenile stranding was classified as good (reduced risk) in 34% of years for EBC1, 40% of the years for EBC2, 29% of the years for EBC2_ELT, and 25% of the years for ESO_ELT (Table 5C.5.2-14). Similarly, the risk of stranding was classified as good in 20% of the years for EBC2_LLT and 22% of the years for ESO_LLT. The 4% decrease in good (low) stranding risk under the ESO_ELT relative to EBC2_ELT would contribute to a small reduction in habitat conditions and increase in juvenile steelhead mortality risk resulting from stranding.

Water temperature modeling (SRWQM) predicts that water temperatures in the Sacramento River at Keswick and Bend Bridge would not differ in any month or water-year type between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT (Table 5C.5.2-15, Table 5C.5.2-16, Table 5C.5.2-17, Table 5C.5.2-18). Further, temperatures at Keswick and Bend Bridge would not differ in any month or water-year type between the ESO scenario and HOS and LOS scenarios (Table 5C.5.2-19, Table 5C.5.2-20, Table 5C.5.2-21, Table 5C.5.2-22). These results indicate that there would be no temperature-related effects on steelhead rearing in the Sacramento River. As a result, no further temperature-related biological analyses necessary on steelhead rearing were conducted.

5C.5.2.1.1.3 Adult

Water Temperature

For this analysis, it was assumed that adult steelhead migrate upstream and hold in the Sacramento River system primarily during the fall, winter, and early spring months (September through March) (McEwan 2001), although adults from some tributary systems may return as early as June (National Marine Fisheries Service 2009). Water temperature modeling (SRWQM) predicts that water temperatures in the Sacramento River at Keswick and Bend Bridge would not differ in any month or water-year type between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT during the September through March period (Table 5C.5.2-15, Table 5C.5.2-16, Table 5C.5.2-17, Table 5C.5.2-18). Further, HOS and LOS scenarios would not differ from ESO in any month or water-year type during the period (Table 5C.5.2-19, Table 5C.5.2-20, Table 5C.5.2-21, Table 5C.5.2-22). This indicates that there would be no temperature-related effects of ESO, HOS, or LOS on steelhead adult migration and holding in the Sacramento River. As a result, no further temperature-related biological analyses on adult steelhead were conducted.

5C.5.2.1.2 Winter-Run

Winter-run Chinook salmon distribution is limited to the upper Sacramento River and its tributaries (Yoshiyama et al. 1998). Construction of Shasta Dam in 1943 and Keswick Dam in 1950 blocked access to upstream waters (Moyle 2002). As a result, the primary spawning and rearing habitats for winter-run Chinook salmon are now confined to the cold water areas between Keswick Dam and Red Bluff Diversion Dam.

5C.5.2.1.2.1 Eggs and Alevins

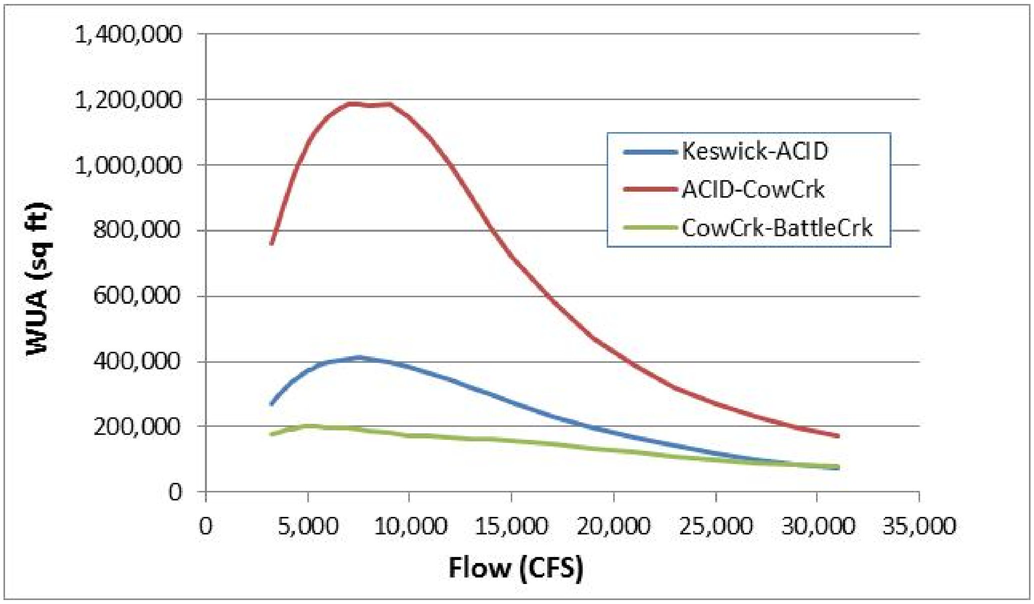
Upstream Spawning Habitat

Winter-run Chinook salmon eggs are subject to potential effects of BDCP operations on habitat conditions affecting egg incubation success through: (1) changes in seasonal water temperatures within the river reach where incubation occurs that result in increased or decreased egg/embryo mortality, and (2) redd dewatering as a result of flow reductions after the redd has been constructed and the eggs are incubating, which exposes the eggs to air and increases egg mortality. The primary seasonal spawning and egg incubation period extends from May through September. Analysis of CALSIM instream flows within the reach where the majority of winter-run Chinook salmon spawning occurs (i.e., Keswick Dam to RBDD) was based on estimated flows at Keswick and upstream of RBDD and are summarized by month and water-year type in Table 5C.5.2-1 and Table 5C.5.2-3, respectively. Differences between pairs of model scenarios are presented in Table 5C.5.2-2 and Table 5C.5.2-4, respectively. Monthly frequency of exceedance plots for Sacramento River flows at Keswick and upstream of RBDD during the winter-run Chinook salmon spawning and egg incubation period (May through September) are presented in Figure 5C.5.2-5 through Figure 5C.5.2-9 and Figure 5C.5.2-17 through Figure 5C.5.2-21, respectively.

As described above in the steelhead section, flows under ESO_ELT and ESO_LLT between May and September are generally predicted to be similar to those under EBC2 ELT and EBC2_LLT, respectively, indicating that the effects of the ESO on Sacramento River flows independent of climate change would be small. There would be some flow increase and reductions in some water-year types and months. In addition, Sacramento River flows under HOS and LOS scenarios would generally be similar to flows under ESO during this period, with some exceptions during November that would not affect winter-run at a population level.

The SacEFT model was used to determine the effects of the ESO on spawning, egg incubation, and juvenile rearing habitat value and quantity characteristics for winter-run Chinook salmon in the upper Sacramento River. SacEFT classifies winter-run spawning habitat availability as good in 58% of years under both EBC1 and EBC2 (Table 5C.5.2-30). The number of years classified as having good spawning habitat availability under the ESO_ELT (37%) would be 9% lower than the number of years under EBC2_ELT (46%). Conversely, number of years classified as having worrisome spawning habitat availability under the ESO_ELT (49%) would be 9% higher than the number of years under EBC2_ELT (58%). The number of years classified as having good spawning habitat availability under the ESO_LLT (23%) would also be 9% lower than the number of years under EBC2_LLT (32%). Conversely, number of years classified as having worrisome spawning habitat availability under the ESO_LLT (63%) would be 8% higher than the number of years under EBC2_LLT (71%).

The empirical Flow-WUA relationship for winter-run Chinook is shown in Figure 5C.5.2-28 and indicates the steep dependence of WUA on flow, especially in the highest-value ACID-CowCrk segment. In most water years under EBC2, the average flow during the winter-run spawning period sits "optimally" at the maximum value of the curve (about 8,800 cfs). Predicted changes in EBC2_ELT result in a WUA decline due to a small *decrease* in average flow; in ESO_ELT, WUA declines due to a small *increase*. The change in percent "good" years is then amplified by the non-linear historical distributions underlying the tercile-based classification used by SacEFT.



Source: U.S. Fish and Wildlife Service 2003: Figure 28; Adapted for SacEFT.

Figure 5C.5.2-28. Spawning Weighted Usable Area (WUA) for Winter-Run Chinook Salmon in the Three River Segments Used by SacEFT Using Flow Data from Keswick (RM 301) and Cow Creek (RM280) (Historical or Simulated)

The biological significance of a reduction in available suitable spawning habitat varies at the population level in response to a number of factors, including adult escapement. For those years when adult escapement is less than the carrying capacity of the spawning habitat, a reduction in area would have little or no population level effect. In years when escapement exceeds carrying capacity of the reduced habitat, competition among spawners for space (e.g., increased redd superimposition) would increase, resulting in reduced reproductive success. The reduction in the frequency of years in which spawning habitat availability is considered to be good by SacEFT could result in reduced reproductive success and abundance of winter-run Chinook salmon if the number of spawners is limited by spawning habitat quantity. Future winter-run Chinook salmon population size is expected to be negatively affected by climate change independent of the BDCP such that spawning habitat availability will be less limiting. The magnitude of potential flow-related effects of the ESO on the population dynamics of winter-run Chinook salmon is discussed in Appendix 5.G, *Fish Life Cycle Models*.

Table 5C.5.2-30. Percentage of Years with Each Rating[a] from SacEFTfor Winter-Run Chinook Salmon Habitat Metrics in the Upper Sacramento River under EBC and ESO Scenarios

Metric	Rating	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Spawning WUA	Good	58	58	46	32	37	23
	Worrisome	39	39	49	63	58	71
	Poor	3	3	5	5	5	6
Redd Scour Risk	Good	98	98	98	98	98	98
	Worrisome	0	0	0	0	0	0
	Poor	2	2	2	2	2	2
Egg Incubation	Good	97	97	88	74	88	72
	Worrisome	0	0	7	12	7	16
	Poor	3	3	5	14	5	12
Redd Dewatering Risk	Good	25	28	29	29	27	28
	Worrisome	33	33	32	32	23	27
	Poor	42	39	39	39	50	45
Juvenile Rearing WUA	Good	50	40	37	25	45	26
	Worrisome	20	18	18	23	20	29
	Poor	30	42	45	52	35	45
Juvenile Stranding Risk	Good	20	32	32	31	12	20
	Worrisome	53	36	40	35	51	42
	Poor	27	32	28	34	37	38

[a] See Attachment 5C.B, *Sacramento River Ecological Flows Tool (SacEFT): Record of Design (v.2.00)*, for definition of “good”, “worrisome”, and “poor” for each performance measure.
[b] See Table 5C.0-1 for definitions of the scenarios.
WUA=Weighted Usable Area.

As reported in Table 5C.5.2-10 and Table 5C.5.2-11, the probability of exceeding the NMFS (2009, in prep.) year-round minimum threshold of 4,000 cfs to keep side channels flowing in the Sacramento River (Table 5C.5.2-9) is nearly identical (<2% difference) between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. Further, flows under the HOS and LOS scenarios would not exceed the 4,000 cfs criterion any less often than the ESO (Table 5C.5.2-12 and Table 5C.5.2-13). This indicates that the ESO, HOS, and LOS would have few, if any, effects to keeping side flows wet in the Sacramento River for winter-run spawning and egg incubation.

High-flow events have the potential to scour redds during incubation, resulting in increased egg mortality. SacEFT classifies the risk of redd scour as good (low risk of scour) in 98% of the years for all six model scenarios (Table 5C.5.2-30). Therefore, redd scour risk is low and not expected to change due to the ESO.

Water Temperature

Water temperature modeling (SRWQM) predicts that water temperatures in the Sacramento River at Keswick and Bend Bridge would not differ in any month or water-year type between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT (Table 5C.5.2-15, Table 5C.5.2-16, Table 5C.5.2-17, Table 5C.5.2-18). Mean monthly water temperatures in the Sacramento River at Keswick and Bend Bridge would not differ between the ESO scenario and HOS and LOS scenarios (Table 5C.5.2-19, Table 5C.5.2-20, Table 5C.5.2-21, Table 5C.5.2-22).

The exceedances of daily water temperatures above a 56°F threshold at Bend Bridge during May through September requested by NMFS were evaluated for winter-run Chinook salmon spawning and egg incubation (Section 5C.4, Table 5C.4-3. In addition, the number of days on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F increments was determined for each month (May through September) and year of the 82-year modeling period. The combination of number of days and degrees above the 56°F threshold were further assigned a "level of concern", as defined in Section 5C.4, Table 5C.4-4. The highest level of concern across all months and all 82 modeled years for each model scenario is presented in Table 5C.5.2-31. Differences between EBC and ESO model scenarios are presented in Table 5C.5.2-32 and between EBC2 scenarios and HOS and LOS scenarios in Table 5C.5.2-33. There would be 4 more years (5%) under ESO_ELT that would be classified as a "red" level of concern relative to EBC2_ELT. This increase of 4 years is considered within the range of modeling error. There would be no differences in level of concern classifications between EBC2_LLT and ESO_LLT. These results indicate that, using this approach, there would be no temperature effects of ESO scenarios on winter-run Chinook salmon spawning and egg incubation in the Sacramento River.

There would be 3 fewer years (4%) under HOS_ELT that would be classified as a "red" level of concern relative to EBC2_ELT Table 5C.5.2-33. However, this increase of 3 years is considered within the range of modeling error. There would be no differences in level of concern classifications between EBC2_LLT and HOS_LLT. There would be small increase (5 years, 7% increase) in the number of years classified as a "red" level of concern under LOS_ELT relative to EBC2_ELT, but no differences between EBC2_LLT and LOS_LLT. These results indicate that, using this approach, there would be no temperature effects of HOS on winter-run Chinook salmon spawning and egg incubation in the Sacramento River. There would be a small effect of LOS_ELT on on winter-run Chinook salmon spawning and egg incubation in the Sacramento River, but no effect of LOS_LLT.

Table 5C.5.2-31. Number of Years in which Water Temperature Exceedances above 56°F Are Within Each Level of Concern, Sacramento River at Bend Bridge, May through September

Level of Concern[a]	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Red	51	50	75	82	79	82	72	81	80	82
Orange	17	11	6	0	3	0	7	1	2	0
Yellow	11	16	1	0	0	0	2	0	0	0
None	3	5	0	0	0	0	1	0	0	0
[a] For definitions of levels of concern, see Section 5C.4, Table 5C.4-4.										

Table 5C.5.2-32. Differences between EBC and ESO Scenarios in the Number of Years in which Water Temperature Exceedances above 56°F Are Within Each Level of Concern, Sacramento River at Bend Bridge, May through September

Level of Concern[a]	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Red	28 (55%)	31 (111%)	32 (64%)	32 (64%)	4 (5%)	0 (0%)
Orange	-14 (-82%)	-17 (121%)	-11 (-100%)	-11 (-100%)	-3 (-100%)	0 (NA)
Yellow	-11 (-100%)	-11 (100%)	-16 (-100%)	-16 (-100%)	-1 (NA)	0 (NA)
None	-3 (-100%)	-3 (100%)	-5 (-100%)	-5 (-100%)	0 (NA)	0 (NA)

[a] For definitions of levels of concern, see Section 5C.4, Table 5C.4-4.
NA = Could not calculate because dividing by 0.

Table 5C.5.2-33. Differences between EBC2 Scenarios and HOS and LOS Scenarios in the Number of Years in which Water Temperature Exceedances above 56°F Are Within Each Level of Concern, Sacramento River at Bend Bridge, May through September

Level of Concern[a]	EBC2_ELT vs. HOS_ELT	EBC2_LLT vs. HOS_LLT	EBC2_ELT vs. LOS_ELT	EBC2_LLT vs. LOS_LLT
Red	-3 (-4%)	-1 (-1%)	5 (7%)	0 (0%)
Orange	1 (17%)	1 (NA)	-4 (-67%)	0 (NA)
Yellow	1 (100%)	0 (NA)	-1 (-100%)	0 (NA)
None	1 (NA)	0 (NA)	0 (NA)	0 (NA)

[a] For definitions of levels of concern, see Section 5C.4, Table 5C.4-4.
NA = Could not calculate because dividing by 0.

Degree-days exceeding 56°F at Bend Bridge were summed by month and water-year type during May through September and are presented in Table 5C.5.2-34. Differences between EBC and ESO model scenarios in degree-days are presented in Table 5C.5.2-35. Differences in exceedances above 56°F between EBC2 and ESO scenarios in ELT and LLT periods are highly variable. In general, there would be a small reduction (up to 11%) in exceedances above 56°F during May and June in both ELT and LLT, and small increases (up to 11%) in exceedances in September during ELT and July, August and September in LLT. Within months, the largest changes would generally occur in above normal, below normal, and dry water years. Combining results, the small increases and decreases in exceedances are not expected to cause biologically meaningful effects to winter-run Chinook salmon spawning and egg incubation at Bend Bridge. It should be noted that this calculation only includes days on which water temperatures would exceed the 56°F threshold and does not include days when water temperature would be below the threshold.

Differences between EBC2 scenarios and HOS and LOS scenarios in degree-days are presented in Table 5C.5.2-36. The number of degree-days under HOS would generally be similar or up to 13% lower than the number under EBC2 depending on month, indicating that HOS would provide a small benefit to winter-run Chinook salmon spawning and egg incubation. The number of degree-days under LOS would be up to 12% lower in May and June and to 16% higher in July, August, and September than the number under EBC2 depending on month and time period, indicating that LOS would provide both a small benefit and a small adverse effect to winter-run Chinook salmon spawning and egg incubation.

Table 5C.5.2-34. Total Degree-Days (°F-Days) by Month and Water-Year Type for Water Temperature Exceedances above 56°F in the Sacramento River at Bend Bridge, May through September

Month	Water-Year Type	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
May	W	377	382	876	1,579	879	1,442	879	1,486	874	1,427
	AN	213	220	448	568	343	441	362	503	343	486
	BN	219	245	507	682	489	653	510	712	446	648
	D	186	217	471	600	372	432	430	578	347	402
	C	221	242	439	631	433	675	409	613	395	649
	All	1,216	1,306	2,741	4,060	2,516	3,644	2,590	3,892	2,405	3,612
Jun	W	384	373	749	1,095	720	884	746	1,029	716	852
	AN	148	137	262	377	242	214	298	395	241	239
	BN	139	137	279	491	260	415	283	513	273	384
	D	188	201	397	722	335	702	390	764	305	646
	C	401	387	645	951	586	1,024	542	1,008	551	1,072
	All	1,260	1,235	2,332	3,636	2,142	3,238	2,259	3,709	2,086	3,193
Jul	W	518	502	740	1,124	684	1,171	693	1,151	683	1,176
	AN	81	73	157	351	186	428	144	380	203	433
	BN	147	163	331	603	303	738	305	653	356	768
	D	282	321	539	1,210	622	1,595	627	1,315	541	1,444
	C	824	941	1,608	2,610	1,559	2,600	1,393	2,262	1,595	2,555
	All	1,852	2,000	3,375	5,898	3,354	6,531	3,162	5,761	3,378	6,376
Aug	W	697	757	1,633	2,660	1,649	2,788	1,550	2,558	1,637	2,850
	AN	408	394	694	1,067	687	1,238	607	1,001	716	1,224
	BN	265	269	757	1,300	730	1,511	671	1,275	805	1,567
	D	670	728	1,478	2,280	1,789	2,733	1,343	2,247	1,885	2,673
	C	1,487	1,575	2,763	4,106	2,696	4,219	2,196	3,771	2,766	4,092
	All	3,527	3,724	7,325	11,414	7,550	12,490	6,367	10,852	7,809	12,406
Sep	W	738	332	747	1,447	830	1,544	785	1,419	1,661	3,059
	AN	714	389	594	1,114	860	1,300	723	1,120	972	1,739
	BN	746	746	1,199	1,892	1,488	2,316	1,483	2,035	1,200	2,024
	D	1,277	1,458	2,526	3,873	2,645	3,702	2,415	3,455	2,459	3,483
	C	2,078	2,054	3,108	3,969	3,059	4,016	2,592	3,769	2,959	3,921
	All	5,553	4,979	8,175	12,298	8,884	12,881	7,998	11,798	9,251	14,226

Table 5C.5.2-35. Differences between EBC and ESO Scenarios in Total Degree-Days (°F-Days) by Month and Water-Year Type for Water Temperature Exceedances above 56°F in the Sacramento River at Bend Bridge, May through September

Month	Water-Year Type	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
May	W	502 (133%)	1065 (282%)	497 (130%)	1060 (277%)	3 (0.3%)	-137 (-9%)
	AN	130 (61%)	228 (107%)	123 (56%)	221 (100%)	-105 (-23%)	-127 (-22%)
	BN	270 (123%)	434 (198%)	244 (100%)	408 (167%)	-18 (-4%)	-29 (-4%)
	D	186 (100%)	246 (132%)	155 (71%)	215 (99%)	-99 (-21%)	-168 (-28%)
	C	212 (96%)	454 (205%)	191 (79%)	433 (179%)	-6 (-1%)	44 (7%)
	All	1300 (107%)	2428 (200%)	1210 (93%)	2338 (179%)	-225 (-8%)	-416 (-10%)
Jun	W	336 (88%)	500 (130%)	347 (93%)	511 (137%)	-29 (-4%)	-211 (-19%)
	AN	94 (64%)	66 (45%)	105 (77%)	77 (56%)	-20 (-8%)	-163 (-43%)
	BN	121 (87%)	276 (199%)	123 (90%)	278 (203%)	-19 (-7%)	-76 (-15%)
	D	147 (78%)	514 (273%)	134 (67%)	501 (249%)	-62 (-16%)	-20 (-3%)
	C	185 (46%)	623 (155%)	199 (51%)	637 (165%)	-59 (-9%)	73 (8%)
	All	882 (70%)	1978 (157%)	907 (73%)	2003 (162%)	-190 (-8%)	-398 (-11%)
Jul	W	166 (32%)	653 (126%)	182 (36%)	669 (133%)	-56 (-8%)	47 (4%)
	AN	105 (130%)	347 (428%)	113 (155%)	355 (486%)	29 (18%)	77 (22%)
	BN	156 (106%)	591 (402%)	140 (86%)	575 (353%)	-28 (-8%)	135 (22%)
	D	340 (121%)	1313 (466%)	301 (94%)	1274 (397%)	83 (15%)	385 (32%)
	C	735 (89%)	1776 (216%)	618 (66%)	1659 (176%)	-49 (-3%)	-10 (-0.4%)
	All	1502 (81%)	4679 (253%)	1354 (68%)	4531 (227%)	-21 (-1%)	633 (11%)
Aug	W	952 (137%)	2091 (300%)	892 (118%)	2031 (268%)	16 (1%)	128 (5%)
	AN	279 (68%)	830 (203%)	293 (74%)	844 (214%)	-7 (-1%)	171 (16%)
	BN	465 (175%)	1246 (470%)	461 (171%)	1242 (462%)	-27 (-4%)	211 (16%)
	D	1119 (167%)	2063 (308%)	1061 (146%)	2005 (275%)	311 (21%)	453 (20%)
	C	1209 (81%)	2732 (184%)	1121 (71%)	2644 (168%)	-67 (-2%)	113 (3%)
	All	4023 (114%)	8963 (254%)	3826 (103%)	8766 (235%)	225 (3%)	1076 (9%)
Sep	W	92 (12%)	806 (109%)	498 (150%)	1212 (365%)	83 (11%)	97 (7%)
	AN	146 (20%)	586 (82%)	471 (121%)	911 (234%)	266 (45%)	186 (17%)
	BN	742 (99%)	1570 (210%)	742 (99%)	1570 (210%)	289 (24%)	424 (22%)
	D	1368 (107%)	2425 (190%)	1187 (81%)	2244 (154%)	119 (5%)	-171 (-4%)
	C	981 (47%)	1938 (93%)	1005 (49%)	1962 (96%)	-49 (-2%)	47 (1%)
	All	3331 (60%)	7328 (132%)	3905 (78%)	7902 (159%)	709 (9%)	583 (5%)

Table 5C.5.2-36. Differences between EBC2 Scenarios and HOS and LOS Scenarios in Total Degree-Days (°F-Days) by Month and Water-Year Type for Water Temperature Exceedances above 56°F in the Sacramento River at Bend Bridge, May through September

Month	Water-Year Type	EBC2_ELT vs. HOS_ELT	EBC2_LLT vs. HOS_LLT	EBC2_ELT vs. LOS_ELT	EBC2_LLT vs. LOS_LLT
May	W	3 (0%)	-93 (-6%)	-2 (-0.2%)	-152 (-10%)
	AN	-86 (-19%)	-65 (-11%)	-105 (-23%)	-82 (-14%)
	BN	3 (1%)	30 (4%)	-61 (-12%)	-34 (-5%)
	D	-41 (-9%)	-22 (-4%)	-124 (-26%)	-198 (-33%)
	C	-30 (-7%)	-18 (-3%)	-44 (-10%)	18 (3%)
	All	-151 (-6%)	-168 (-4%)	-336 (-12%)	-448 (-11%)
Jun	W	-3 (0%)	-66 (-6%)	-33 (-4%)	-243 (-22%)
	AN	36 (14%)	18 (5%)	-21 (-8%)	-138 (-37%)
	BN	4 (1%)	22 (4%)	-6 (-2%)	-107 (-22%)
	D	-7 (-2%)	42 (6%)	-92 (-23%)	-76 (-11%)
	C	-103 (-16%)	57 (6%)	-94 (-15%)	121 (13%)
	All	-73 (-3%)	73 (2%)	-246 (-11%)	-443 (-12%)
Jul	W	-47 (-6%)	27 (2%)	-57 (-8%)	52 (5%)
	AN	-13 (-8%)	29 (8%)	46 (29%)	82 (23%)
	BN	-26 (-8%)	50 (8%)	25 (8%)	165 (27%)
	D	88 (16%)	105 (9%)	2 (0.4%)	234 (19%)
	C	-215 (-13%)	-348 (-13%)	-13 (-1%)	-55 (-2%)
	All	-213 (-6%)	-137 (-2%)	3 (0.1%)	478 (8%)
Aug	W	-83 (-5%)	-102 (-4%)	4 (0.2%)	190 (7%)
	AN	-87 (-13%)	-66 (-6%)	22 (3%)	157 (15%)
	BN	-86 (-11%)	-25 (-2%)	48 (6%)	267 (21%)
	D	-135 (-9%)	-33 (-1%)	407 (28%)	393 (17%)
	C	-567 (-21%)	-335 (-8%)	3 (0.1%)	-14 (-0.3%)
	All	-958 (-13%)	-561 (-5%)	484 (7%)	993 (9%)
Sep	W	38 (5%)	-28 (-2%)	914 (122%)	1612 (111%)
	AN	129 (22%)	6 (1%)	378 (64%)	625 (56%)
	BN	284 (24%)	143 (8%)	1 (0.1%)	132 (7%)
	D	-111 (-4%)	-418 (-11%)	-67 (-3%)	-390 (-10%)
	C	-516 (-17%)	-200 (-5%)	-149 (-5%)	-48 (-1%)
	All	-176 (-2%)	-497 (-4%)	1077 (13%)	1931 (16%)

The Reclamation egg mortality model predicts the effects of changes to water temperature under the ESO relative to EBC scenarios on winter-run egg mortality. Results are presented in Table 5C.5.2-37 and indicate that: (1) egg mortality increases substantially during critically dry water years in all model scenarios, which is a result of depleted Shasta Reservoir coldwater pool storage and increased temperatures of water (Table 5C.5.2-15, Table 5C.5.2-16) released to the mainstem Sacramento River during the winter-run incubation period; (2) egg mortality under EBC1 is similar to EBC2; (3) a trend toward increasing egg mortality in the future exists as a result of increased air and water temperatures associated with climate change and changes in expected future hydrologic conditions; (4) the effects of climate change on winter-run Chinook salmon egg mortality are expected to become greater with time for EBC2 and ESO conditions; and (5) egg mortality under

ESO_ELT and ESO_LLT is predicted to be similar to egg mortality under EBC2_ELT and EBC2_LLT, respectively.

Table 5C.5.2-37. Egg Mortality Percentages for Winter-Run Chinook in the Mainstem Sacramento River under EBC and ESO Scenarios

Water-Year Type	Scenario[a]					
	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Wet	0.4	0.4	0.8	1.5	0.8	1.5
Above Normal	0.5	0.4	0.9	2.1	0.9	2.0
Below Normal	1.0	0.9	1.3	1.8	1.6	3.2
Dry	1.5	1.8	3.1	7.4	3.1	8.2
Critical	26.9	29.0	49.7	71.2	45.3	69.1
All	4.7	5.0	8.7	13.3	8.1	13.4

Source: Reclamation egg mortality model.
[a] See Table 5C.0-1 for definitions of the scenarios.

SacEFT classifies incubation habitat conditions for winter-run salmon eggs ("Egg-To-Fry Thermal Mortality" in SacEFT documentation; Attachment 5C.B *Sacramento River Ecological Flows Tool (SacEFT): Record of Design (v.2.00)*) as good in 97% of years for EBC1 and EBC2, 88% of years for EBC2_ELT and ESO_ELT, and 74% and 72% of years for EBC2_LLT and ESO_LLT, respectively (Table 5C.5.2-30). These results suggest that incubation temperature conditions under ESO_ ELT and ESO_LLT would be comparable to EBC2_ELT and EBC2_LLT, respectively, but that future climate change will reduce incubation temperature conditions (e.g., EBC2 vs. EBC2_ELT vs. EBC2_LLT).

Redd Dewatering

The potential risk of redd dewatering is a function of river flow during spawning and subsequent flow reductions during the incubation period. SacEFT classifies the risk of winter-run Chinook salmon redd dewatering in the mainstem Sacramento River as good (reduced dewatering risk) in 25% of years for EBC1, 28% of years for EBC2, 29% of years for EBC2_ELT, and 27% of years for ESO_ELT (Table 5C.5.2-30). The risk of redd dewatering is classified as good in 29% of years for EBC2_LLT and 28% of years for ESO_LLT. The number of years with poor redd dewatering conditions would be 11% and 8% higher under ESO_ELT and ESO_LLT relative to EBC2_ELT and EBC2_LLT, respectively. These results indicate that there would be a small adverse effect of the ESO on winter-run Chinook salmon.

5C.5.2.1.2.2 Fry and Juvenile Rearing

Rearing Habitat

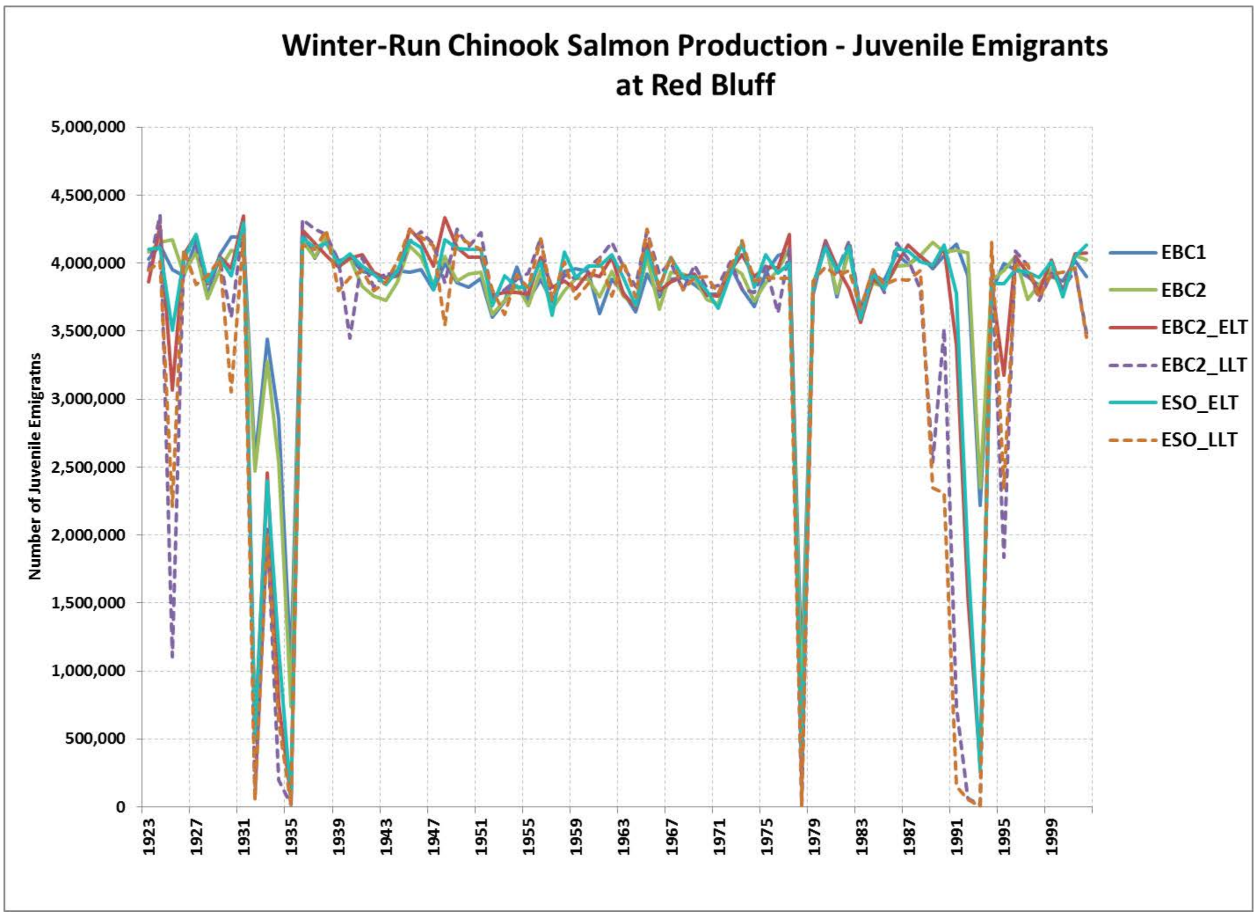
Upstream juvenile winter-run salmon rearing occurs during August through December before migrating downstream to the ocean (Gaines and Martin 2002). Upstream Sacramento River flows during this period are generally similar between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT, indicating that the ESO does not affect flow rates in the Sacramento River (Table 5C.5.2-1 through Table 5C.5.2-4; Figure 5C.5.2-1 through Figure 5C.5.2-24). One exception is during November, in which flows would be 5% to 23% lower under the ESO than EBC2 depending on water-year type and implementation period. This reduction is not expected to affect winter-run in a biologically meaningful way, which is further confirmed by the similarity between EBC2 and ESO in the frequency of meeting minimum flow standards for upstream species (Table 5C.5.2-10 and Table 5C.5.2-11). Similarly, the only differences in Sacramento River flows during this period between the ESO scenario and HOS and LOS scenarios would occur during November, in which flows would be up to 17% lower under LOS_LLT relative to ESO_LLT (Table 5C.5.2-5 through Table 5C.5.2-8). These reductions occur in one of the five rearing months and do not occur in every water year.

As reported above, there would be very small (<2%) differences in water temperature in the Sacramento River at Keswick or Bend Bridge in all months and water-year types between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT (Table 5C.5.2-15 through Table 5C.5.2-18). The largest change in average temperature would be an increase of 0.1°F, or 1.7%, which would occur at Bend Bridge in below normal water years during September. Further, there would be no differences between the ESO scenario and HOS or LOS scenarios (Table 5C.5.2-19, Table 5C.5.2-20, Table 5C.5.2-21, Table 5C.5.2-22). Therefore, water temperatures during the winter-run juvenile rearing period will not be affected by the ESO, HOS, or LOS.

Potential flow and temperature effects on juvenile winter-run rearing habitat were modeled using SacEFT. SacEFT classifies upstream juvenile winter-run salmon rearing habitat as good in 50% of years for EBC1 and 40% of years for EBC2 (Table 5C.5.2-30). Habitat was classified as good in 37% of years for EBC2_ELT and 45% of years for ESO_ELT. Habitat was classified as good in 25% of years for EBC2_LLT and 26% of years for ESO_LLT. These results suggest that the value and quantity of suitable habitat for juvenile winter-run Chinook salmon rearing is expected to decline over time in response to changes in climate; however, the frequency of years with good habitat conditions is predicted to increase by 8%for ESO_ELT relative to EBC2_ELT and the number of years with poor juvenile rearing WUA under ESO_ELT (45%) would decrease by 10% to 35% of years under EBC2_ELT. Although the percentage of years with good juvenile rearing WUA would be similar between EBC2_LLT and ESO_LLT (25% and 26%, respectively), the percentage of years with poor juvenile rearing WUA would decrease by 7% from EBC2_LLT to ESO_LLT and would be classified as worrisome, which is better under SacEFT than poor. It is expected that the increased frequency of good years in the early long-term and the reduced frequency of poor years in the late long-term would provide a small benefit to juvenile winter-run salmon rearing. In spite of the similarity of CALSIM exceedance plots across some scenarios, in SacEFT the monthly Sacramento River flows are subsequently modified by the SRWQM model to create synthetic daily flow estimates which emulate natural variability. Patterns of daily flow are important for Rearing WUA and strongly influence SacEFT results, even though monthly flows may not change much.

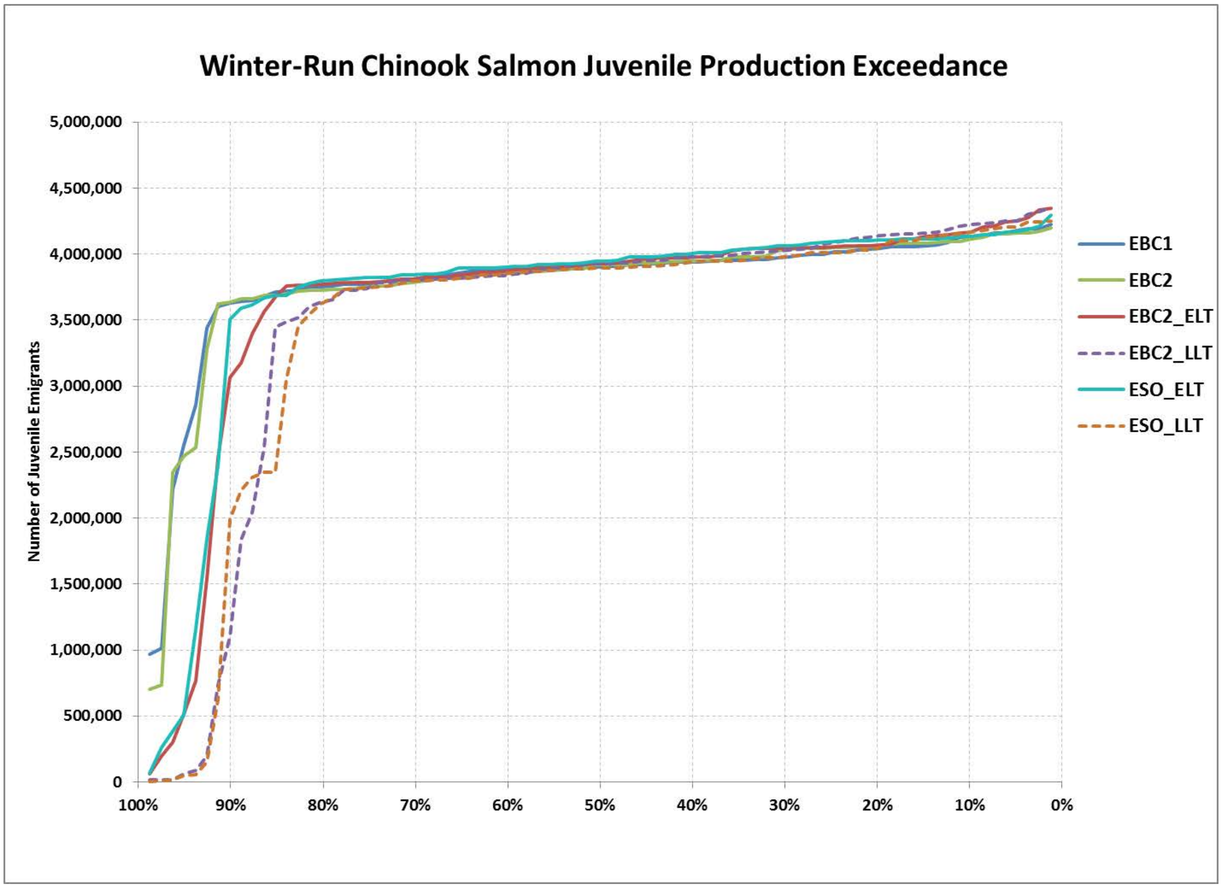
SacEFT classifies juvenile stranding risk for winter-run Chinook salmon as good (low risk of stranding) in 20% of years under EBC1 and 32% of years under EBC2 (Table 5C.5.2-30). Stranding risk was classified as good in 32% of years under EBC2_ELT and 12% of years under ESO_ELT, a 20% decrease on an absolute scale (38% on a relative scale). Stranding risk was classified as good in 31% of years under EBC2_ELT and 20% of years under ESO_ELT, an 11% decrease on an absolute scale (35% on a relative scale). This increased risk of stranding under the ESO is due to larger flow fluctuations during August through December juvenile stranding period (Table 5C.5.2-1 through Table 5C.5.2-4). Stranding risk in SacEFT is driven almost completely by daily declining changes in flow (with a minor role for temperature, which affects juvenile emergence), combined with the empirical relationship between absolute flow and available rearing habitat area. This can create a paradoxical situation in which there can be more rearing habitat combined with more variability. The first will improve the number “good” years for rearing WUA, while the second will increase the stranding risk.

Flows and temperature effects on Chinook salmon juvenile rearing habitat upstream of RBDD were also evaluated using the SALMOD model. The primary output from SALMOD is a direct assessment of project effects based on estimates of the number of juvenile Chinook salmon emigrating past RBDD. Winter-run Chinook salmon SALMOD runs used an adult escapement value of 8,591 individuals (average escapement from 1999–2006). Figure 5C.5.2-29 and Figure 5C.5.2-30 present a time series and exceedance plot, respectively, of production for each model scenario. Production is predicted to typically be the lowest under all model scenarios during major historical dry periods (1929–1934, 1976–1977, and 1987–1992) (Figure 5C.5.2-29). Juvenile production is predicted to be similar between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT (Figure 5C.5.2-30). Climate change appears to be a major driver of production; ELT model scenarios with and without the ESO are lower than EBC1 and EBC2 (under current climate), and LLT model scenarios with and without the BDCP are even lower.



Note: All life stages are combined and converted to smolt equivalents.

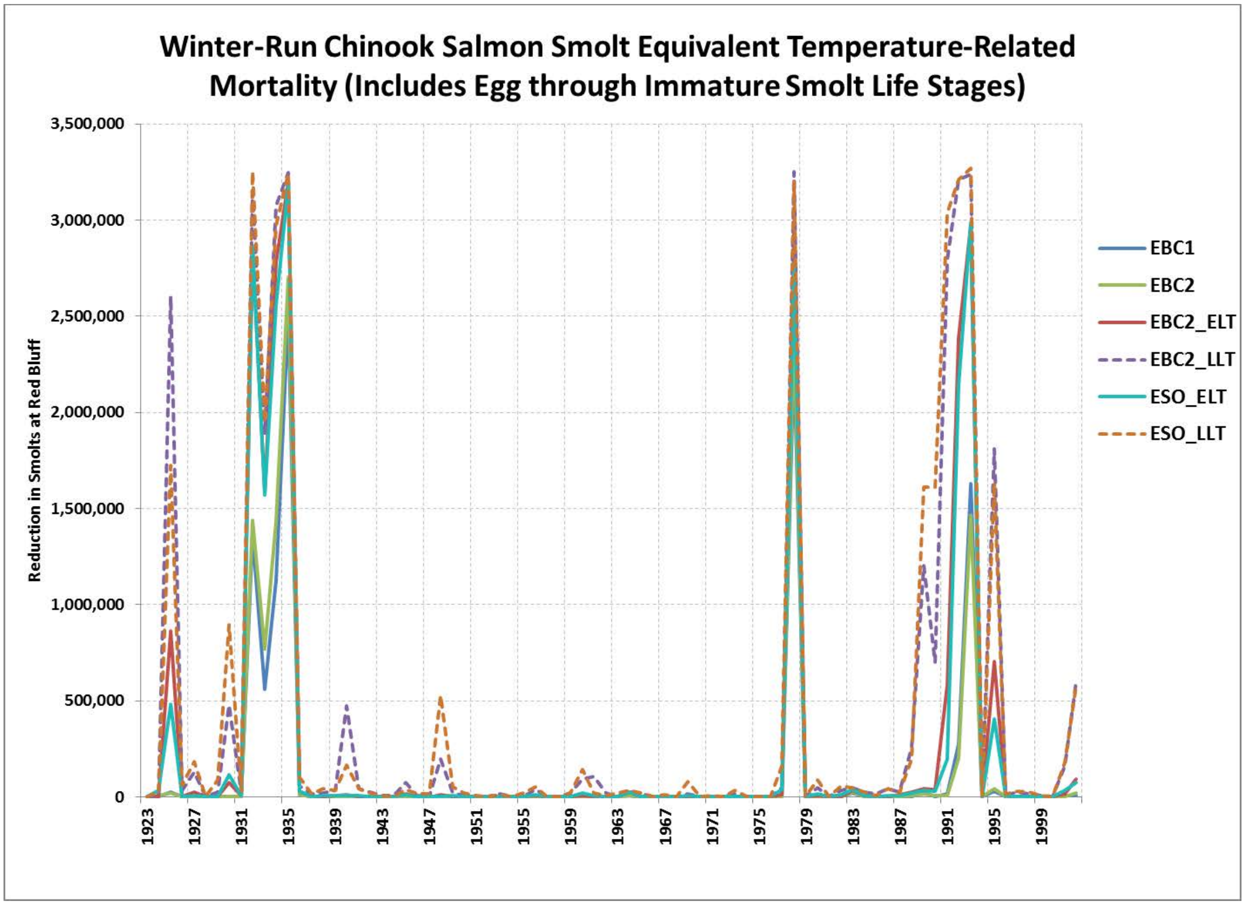
Figure 5C.5.2-29. Winter-Run Chinook Salmon Production at Red Bluff Diversion Dam under EBC and ESO Scenarios (SALMOD Model)



Note: All life stages are combined and converted to smolt equivalents.

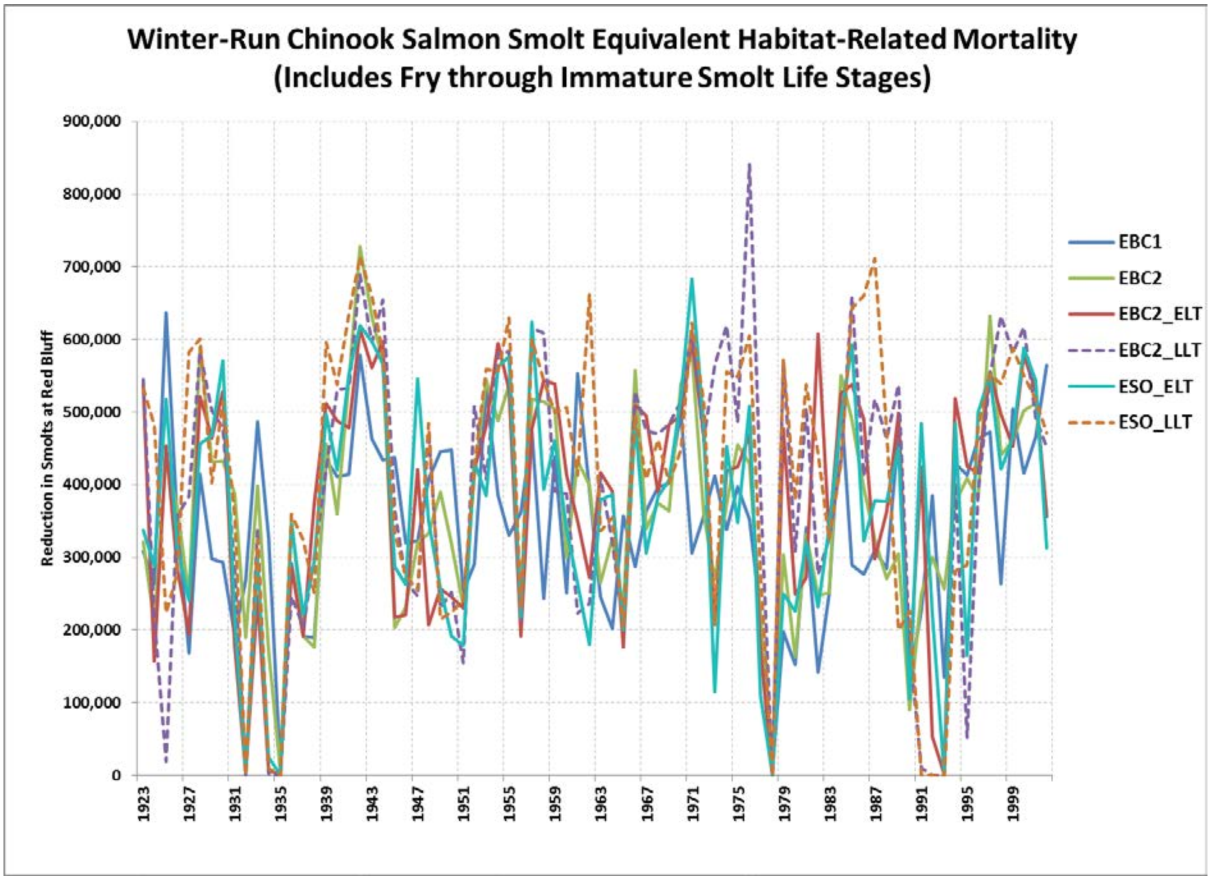
Figure 5C.5.2-30. Winter-Run Chinook Salmon Production Exceedance at Red Bluff Diversion Dam under EBC and ESO Scenarios (SALMOD Model)

Smolt-equivalent temperature-related mortality through time is shown in Figure 5C.5.2-31 and habitat-related mortality is shown in Figure 5C.5.2-32. Figure 5C.5.2-33 and Figure 5C.5.2-34 display exceedance plots of temperature- and habitat-related mortality, respectively. Winter-run temperature-related mortality varies with water-year type and is predicted to occur primarily in the driest years. Some habitat-related mortality occurs in most years under all scenarios, except for years when temperature-related mortality is high. Few eggs survive to the fry life stage in years of high-temperature-related mortality; therefore, habitat limitations are low when the number and density of juvenile salmon is reduced. Habitat-related mortality appears to be loosely related to climate change, as evidenced by the highest mortality predicted to occur in the late long-term both with and without the project, followed by both scenarios in the early long-term, and the lowest mortality predicted to occur in EBC1 and EBC2 under current climate conditions. There would be no effects of the ESO on habitat-related mortality. The best habitat conditions are predicted to occur in wet years and the worst habitat conditions are predicted to occur in critically dry water years under the EBC1, EBC2, ESO_ELT, and ESO_LLT. Temperature-related mortality is predicted to follow the same pattern of minor effects from climate change, but no project-related effects. Temperature-related mortality is expected to occur in fewer years than habitat-related mortality, but in years of high-temperature mortality, total production would be reduced, likely affecting ultimate adult production. This could affect population viability if entire brood years have very low adult returns, particularly if returns are low in successive years.



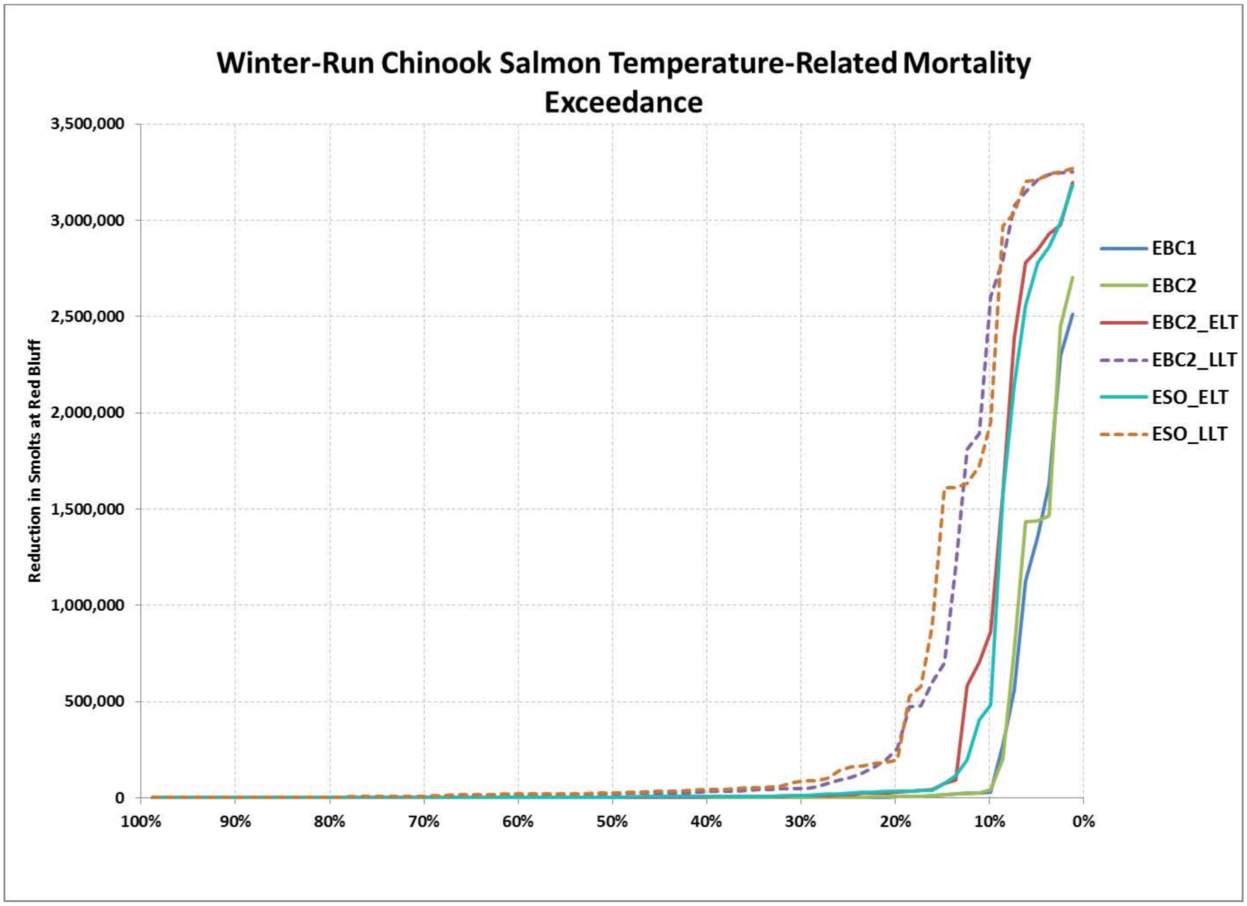
Note: All life stages are combined and converted to smolt equivalents.

Figure 5C.5.2-31. Winter-Run Chinook Salmon Temperature-Related Mortality (Egg through Smolt) under EBC and ESO Scenarios (SALMOD Model)



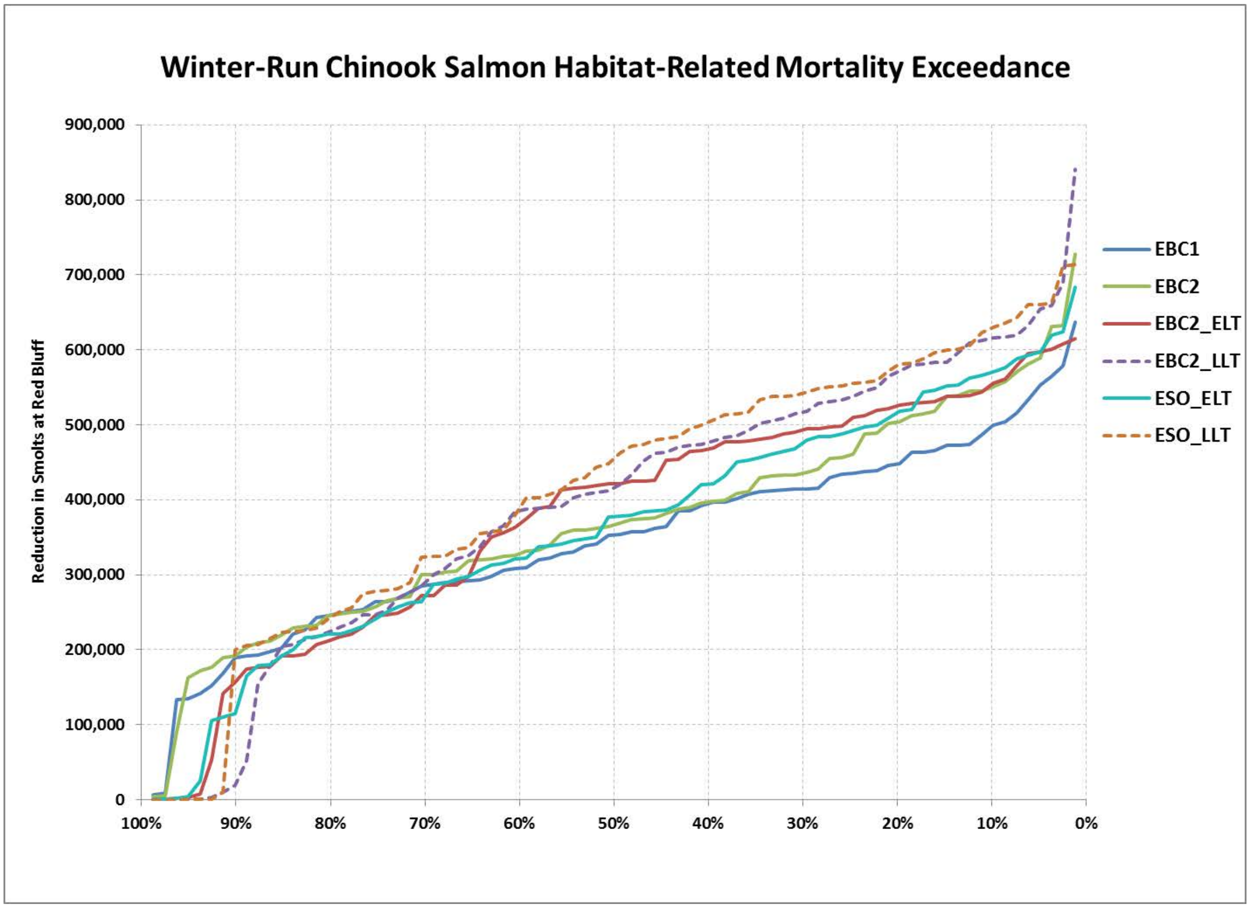
Note: All juvenile life stages are combined and converted to smolt equivalents.

Figure 5C.5.2-32. Winter-Run Chinook Salmon Habitat-Related Mortality (Fry through Smolt) under EBC and ESO Scenarios (SALMOD Model)



Note: All life stages are combined and converted to smolt equivalents.

Figure 5C.5.2-33. Winter-Run Chinook Salmon Temperature-Related Mortality (Egg through Smolt) Exceedance under EBC and ESO Scenarios (SALMOD Model)



Note: All life stages are combined and converted to smolt equivalents.

Figure 5C.5.2-34. Winter-Run Chinook Salmon Habitat-Related Mortality (Fry through Smolt) Exceedance under EBC and ESO Scenarios (SALMOD Model)

SALMOD-generated estimates of juvenile winter-run Chinook salmon production are summarized in Table 5C.5.2-38. These results reflect changes in habitat value and quantity based on habitat estimates each year over the 82-year CALSIM period and assume an adult escapement each year of 8,591 adult winter-run Chinook salmon. The predicted production of juvenile winter-run Chinook salmon varies substantially among years (comparison of predicted minimum and maximum for each model scenario). Factors that affect juvenile production among years include adult escapement (which holds constant in these model simulations); interannual variation in instream flows that affect the quantity and value of suitable habitat (e.g., water depths and velocities); and exposure to elevated water temperatures. Typically juvenile production and survival are higher in years when river flows are higher (up to the point when higher flows increase depth and velocity beyond the preferred range) and water temperatures are reduced. Reduced juvenile production and survival typically occurs when river flows are low and water temperatures are elevated. Average juvenile production model predictions were generally similar across model scenarios based on both the average annual and maximum production estimates (Table 5C.5.2-38). In contrast, there was substantial variation in minimum production estimates among scenarios. The highest minimum estimate (966,547 individuals) was for EBC1 conditions, which were not subject to either BDCP operations or future climate change. The minimum production declined substantially under ELT conditions to 59,877 individuals for EBC2_ELT and 66,221 individuals for ESO_ELT operations. Under LLT conditions with greater effects of climate change on hydrology and water temperatures, the minimum production estimates declined further to 13,459 individuals under EBC2_LLT and 5,828 individuals under ESO_LLT conditions. These results suggest that the severity of adverse conditions becomes greater over time in response to future climate change conditions.

Table 5C.5.2-38. Winter-Run Chinook Salmon Juvenile Production Estimates for EBC and ESO Scenarios

Estimate	Scenario[a]					
	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Minimum	966,547	703,344	59,877	13,459	66,221	5,828
Maximum	4,227,200	4,199,200	4,348,962	4,355,292	4,294,202	4,249,796
Average	3,791,026	3,776,827	3,666,881	3,522,375	3,698,912	3,486,952
Change (Percent) from Average EBC2_ELT					32,031(0.9%)	
Change (Percent) from Average EBC2_LLT						-35,423 (-1.0%)
Source: SALMOD model. [a] See Table 5C.0-1 for definitions of the scenarios.						

A threshold value of <100,000 individuals was evaluated as a measure of the worst case scenario for winter-run Chinook salmon. The number of years in which the juvenile production estimate was <100,000 individuals was calculated (Table 5C.5.2-39) and compared between model scenarios (Table 5C.5.2-40). These results indicate that there would be one year under both EBC2_ELT and ESO_ELT and five years under both EBC2_LLT and ESO_LLT in which juvenile production woule be below 100,000 individuals. Therefore, there would be no effect of ESO on the frequency of worst case scenario years for winter-run Chinook salmon juvenile production.

Table 5C.5.2-39. Number of Years during which Winter-Run Chinook Salmon Juvenile Production Estimates Are Lower than 100,000 Individuals for EBC and ESO Scenarios

Scenario[a]	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Number of Years	0	0	1	5	1	5
Source: SALMOD model. [a] See Table 5C.0-1 for definitions of the scenarios.						

Table 5C.5.2-40. Differences between EBC and ESO Scenarios in Number of Years during which Winter-Run Chinook Salmon Juvenile Production Estimates Would Be Lower than 100,000 Individuals

Comparison[a]	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Difference	1 (NA)	5 (NA)	1 (NA)	5 (NA)	0 (0%)	0 (0%)
Source: SALMOD model. [a] See Table 5C.0-1 for definitions of the scenarios.						

Results of these analyses show (1) there is a wide range of mortality estimates among years for all of the conditions modeled (range between minimum and maximum estimates of mortality); (2) based on average conditions, estimated juvenile winter-run Chinook salmon production for the ESO_ELT and ESO_LLT is not different from EBC2_ELT and EBC2_LLT conditions, respectively (within 1%);

and (3) when comparing the EBC2 to EBC2_ELT and EBC2_LLT, there appears to be a consistent trend of reduced average juvenile production as a result of climate change.

The results from SALMOD are consistent with SacEFT results that indicate that egg mortality, redd scour risk, redd dewatering risk, and juvenile rearing WUA for winter-run Chinook salmon in the Sacramento River would not change during the LLT due to the ESO (Table 5C.5.2-30). However, these results are inconsistent with SacEFT results that indicate that there would be differences between EBC2 and ESO scenarios in juvenile rearing WUA during the ELT and in spawning WUA and juvenile stranding risk during both the ELT and LLT. Both SacEFT and SALMOD are considered to be reliable models for winter-run Chinook salmon in the Sacramento River. Although the SacEFT model has been peer-reviewed, SALMOD has been extensively reviewed and used in prior biological assessments and BiOps. Therefore, both results are considered valid and were considered in drawing conclusions about winter-run Chinook salmon. Further, life cycle population model results for winter-run Chinook salmon (IOS and OBAN) integrate across all life stages as discussed in Appendix 5.G, *Fish Life Cycle Models,* and were further used in the interpretation of effects of the ESO on winter-run Chinook salmon.

There are four analyses used in this effects analysis that analyze temperature-related effects of the BDCP on winter-run Chinook salmon early life stages (eggs, fry, and juveniles) in the upper Sacramento River. The NMFS water temperatures threshold analysis, SacEFT, and the Reclamation egg mortality model all predict that there would be no effect of the BDCP on winter-run Chinook salmon eggs. SALMOD also predicts that average juvenile witer-run production estimates would not be affected by BDCP, but there would be lower minimum production estimates under BDCP. However, there would be no effect of BDCP on the number of years under a ‘worst case scenario’ (<100,000 spawners) for winter-run Chinook salmon predicted by SALMOD (Table 5C.5.2-39 and Table 5C.5.2-40). Therefore, overall, using a weight or evidence approach, it is concluded that there would be no water temperature-related effects of the BDCP on winter-run Chinook salmon in the upper Sacramento River. The IOS and OBAN lifecycle models also evaluate the effects of water temperature on winter-run Chinook salmon in the Sacramento River, although modeling artifacts limit the ability to derive conclusions with confidence (Appendix 5.G, *Fish Life Cycle Models*).

5C.5.2.1.2.3 Adult

Water Temperature

Adult winter-run Chinook salmon migrate upstream in the mainstem Sacramento River during winter (December through August) and hold in the upper river reaches through the spring and early summer prior to spawning in March through August (Vogel and Marine 1991; Meyers 1998; National Marine Fisheries Service 2009).

Predicted average water temperatures by month and water-year type for the Sacramento River at Keswick and Bend Bridge, representative adult holding sites in the upper Sacramento River, are presented in Table 5C.5.2-15 and Table 5C.5.2-16, respectively and differences between model scenarios are presented in Table 5C.5.2-17 and Table 5C.5.2-18, respectively. These results indicate that there would be very small (<2%) differences in water temperature in the Sacramento River at Keswick or Bend Bridge during December through August regardless of water-year type between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. Similarly, there would be no differences in water temperatures between the ESO scenario and HOS or LOS scenarios (Table 5C.5.2-19, Table 5C.5.2-20, Table 5C.5.2-21, Table 5C.5.2-22). Given these results, it was concluded that there would be no water temperature-related effects of the ESO, HOS, or LOS on winter-run adult migration and holding conditions. Therefore, it was determined that no further temperature-related biological analyses for winter-run adult migration and holding conditions were conducted.

5C.5.2.1.3 Spring-Run

Naturally spawning populations of Sacramento River spring-run Chinook salmon with consistent spawning returns are currently restricted to Butte Creek, Deer Creek, and Mill Creek (Good et al. 2005), although returns to Battle Creek have increased in recent years. There is low and inconsistent spawning in the Sacramento River primarily above Red Bluff Diversion Dam (Azat 2012).

5C.5.2.1.3.1 Eggs and Alevins

Upstream Spawning Habitat

Instream flows in the Sacramento River between Keswick and RBDD during the spring-run Chinook salmon spawning and incubation period (September through January) are shown in Table 5C.5.2-1, Table 5C.5.2-3, Figure 5C.5.2-1, Figure 5C.5.2-9 through Figure 5C.5.2-12, Figure 5C.5.2-13, and Figure 5C.5.2-21 through Figure 5C.5.2-24. Differences between pairs of model scenarios are presented by month and water-year type in Table 5C.5.2-2 and Table 5C.5.2-4. Flows under the ESO_ELT and ESO_LLT are predicted to be similar to or greater than flows under EBC2_ELT and EBC2_LLT and ESO_LLT, respectively, during all months of the spawning and incubation period except November in which be flows would be 5% to 23% lower than future EBC2 depending on location, water-year type, and implementation period. These small reductions are not expected to affect spring-run Chinook salmon at a population level because only a small proportion of spring-run spawn in the Sacramento River. Similarly, differences during November between ESO and LOS (Table 5C.5.2-6 and Table 5C.5.2-8) would not affect the species at a population level. Overall, there would be no major differences between the ESO scenario and HOS and LOS scenarios in flows during the spring-run spawning and egg incubation period.

The SacEFT model classifies spring-run spawning habitat conditions as good in 70% of years under EBC1 and 55% of the years under EBC2 (Table 5C.5.2-41). Spawning habitat conditions are classified as good in 57% of the years for EBC2_ELT and in 55% of the years for ESO_ELT, which is a 2%, or negligible, reduction due to the ESO. Spawning habitat conditions during the LLT period are classified as good in 49% of years for EBC2_LLT and 46% of years for ESO_LLT, which is a 3%, or negligible, reduction due to the ESO. These results indicate that habitat conditions for spawning are expected to decline slightly in the future in response to climate change, but that spawning conditions will not change due to the ESO. However, because there is no information regarding spawning locations for spring-run Chinook salmon in Gard (2005), SacEFT applies fall-run Chinook salmon spawning locations for spring-run Chinook salmon, reducing the certainty in SacEFT results.

Table 5C.5.2-41. Percentage of Years with Each Rating[a] from SacEFT for Spring-Run Chinook Salmon Habitat Metrics in the Upper Sacramento River under EBC and ESO Scenarios

		Scenario[b]					
Metric	**Rating**	**EBC1**	**EBC2**	**EBC2_ELT**	**EBC2_LLT**	**ESO_ELT**	**ESO_LLT**
Spawning WUA	Good	70	55	57	49	55	46
	Worrisome	5	8	8	13	16	19
	Poor	25	37	35	38	29	35
Redd Scour Risk	Good	100	100	100	100	100	100
	Worrisome	0	0	0	0	0	0
	Poor	0	0	0	0	0	0
Egg Incubation	Good	86	85	65	34	58	22
	Worrisome	2	3	10	12	16	13
	Poor	12	12	25	54	26	65
Redd Dewatering Risk	Good	49	37	41	34	39	32
	Worrisome	32	39	30	27	23	28
	Poor	19	24	29	39	38	40
Juvenile Rearing WUA	Good	22	23	25	22	28	26
	Worrisome	39	35	33	38	32	34
	Poor	39	42	42	40	40	40
Juvenile Stranding Risk	Good	19	18	20	14	20	12
	Worrisome	42	36	38	40	35	43
	Poor	39	46	42	46	45	45

[a] See Attachment 5C.B, *Sacramento River Ecological Flows Tool (SacEFT): Record of Design (v.2.00)*, for definition of "good", "worrisome", and "poor" for each performance measure.
[b] See Table 5C.0-1 for definitions of the scenarios.
WUA=Weighted Usable Area.

As reported in Table 5C.5.2-10 and Table 5C.5.2-11, the probability of exceeding the NMFS (2009, in prep.) year-round minimum threshold of 4,000 cfs to keep side channels flowing in the Sacramento River is nearly identical (<2% difference) between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. This indicates that the ESO would have few, if any, effects to keeping sides wet in the Sacramento River for spring-run spawning and egg incubation. Further, the frequency of exceedance above 4,000 cfs under HOS and LOS generally be similar to the frequency under EBC2 scenarios (Table 5C.5.2-12, Table 5C.5.2-13), indicating that HOS and LOS scenarios would have no effect on keeping sides wet in the Sacramento River for spring-run spawning and egg incubation.

High-flow events have the potential to scour redds during incubation, resulting in increased embryonic mortality. SacEFT results showed that the risk of redd scour was classified as good (reduced risk) in 100% of the years for all model scenarios (EBC1, EBC2, EBC2_ELT, EBC2_LLT, ESO_ELT, and ESO_LLT) (Table 5C.5.2-41). Based on these results, it was concluded that the risk of spring-run salmon redd scour and embryo mortality is low with and without the project.

Water Temperature

Spring-run Chinook salmon spawning in the Sacramento River in recent years (2000–2011) has been inconsistent, but primarily occurs between Keswick Dam and RBDD (Azat 2012). Water temperature modeling (SRWQM) predicts that water temperatures in the Sacramento River at

Keswick and Bend Bridge would not differ in any month or water-year type between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT (Table 5C.5.2-15, Table 5C.5.2-16, Table 5C.5.2-17, Table 5C.5.2-18). This indicates that there would be no temperature-related effects on spring-run Chinook salmon eggs and alevins in the Sacramento River. Similarly, there would be no differences in mean monthly water temperatures in the Sacramento River between the ESO scenario and the LOS and HOS scenarios (Table 5C.5.2-19, Table 5C.5.2-20, Table 5C.5.2-21, Table 5C.5.2-22).

The exceedances of daily water temperatures above a 56°F threshold at Bend Bridge during May through September and at Red Bluff during October through April as requested by NMFS were used to evaluate the potential water temperature-related effects of BDCP on spring-run Chinook salmon holding, spawning, and egg incubation (Section 5C.4, Table 5C.4-3).

Table 5C.5.2-31 through Table 5C.5.2-33 present "level of concern" results for Bend Bridge for EBC2, ESO, HOS, and LOS scenarios. As described above for winter-run Chinook salmon, results indicate that there would be no temperature-related effects of the ESO of HOS at Bend Bridge from May through September and, therefore, no effects on spring-run Chinook salmon. There would be a small effect of LOS_ELT on spring-run Chinook salmon spawning and egg incubation at Bend Bridge, but no effect of LOS_LLT.

Table 5C.5.2-42 through Table 5C.5.2-44 present "level of concern" results for Red Bluff for EBC2, ESO, HOS, and LOS scenarios. During the ELT, the number of years within each level of concern would not differ between EBC2 and ESO by more than 2 years, indicating negligible effects of the BDCP. In the LLT, the number of red and orange years would be higher under ESO by 2 and 3 years (4% and 23%), respectively. However, it is unlikely that 2 to 3 years with a higher level of concern over the 82-year modeled period would have a biologically meaningful effect on the spring-run population in this location.

There would be 5 fewer years (38%) under HOS_ELT at Red Bluff that would be classified as a "orange" level of concern and 6 more years (27%) with no level of concern relative to EBC2_ELT (Table 5C.5.2-44). This represents a small benefit to spring-run Chinook salmon by HOS. There would be 2 more years under HOS_LLT that would be classified as "red" and "orange" levels of concern and 4 fewer years that would be classified with a "yellow" level of concern. However, it is unlikely that a change of 2 to 4 years over the 82-year modeled period would have a biologically meaningful effect on the spring-run population. There would be no biologically meaningful differences between EBC2_ELT and LOS_ELT, but there would be 6 fewer years (13% reduction) with a "red" level of concern and 8 more years (62% increase) with an "orange" level of concern under LOS_LLT relative to EBC2_LLT, representing a small benefit of LOS_LLT on spring-run Chinook salmon at Red Bluff.

Table 5C.5.2-42. Number of Years in which Water Temperature Exceedances above 56°F Are Within Each Level of Concern, Sacramento River at Red Bluff, October through April

Level of Concern[a]	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Red	12	12	21	48	22	50	21	50	19	42
Orange	6	5	13	13	11	16	8	15	13	21
Yellow	13	19	26	12	27	10	25	8	28	11
None	51	46	22	9	22	6	28	9	22	8

[a] For definitions of levels of concern, see Section 5C.4, Table 5C.4-4.

Table 5C.5.2-43. Differences between EBC and ESO Scenarios in the Number of Years which Water Temperature Exceedances above 56°F Are Within Each Level of Concern, Sacramento River at Red Bluff, October through April

Level of Concern[a]	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Red	10 (83%)	38 (317%)	38 (317%)	38 (317%)	1 (5%)	2 (4%)
Orange	5 (83%)	10 (167%)	11 (220%)	11 (220%)	-2 (-15%)	3 (23%)
Yellow	14 (108%)	-3 (-23%)	-9 (-47%)	-9 (-47%)	1 (4%)	-2 (-17%)
None	-29 (-57%)	-45 (-88%)	-40 (-87%)	-40 (-87%)	0 (0%)	-3 (-33%)

[a] For definitions of levels of concern, see Section 5C.4, Table 5C.4-4.

Table 5C.5.2-44. Differences between EBC2 Scenarios and HOS and LOS Scenarios in the Number of Years which Water Temperature Exceedances above 56°F Are Within Each Level of Concern, Sacramento River at Red Bluff, October through April

Level of Concern[a]	EBC2_ELT vs. HOS_ELT	EBC2_LLT vs. HOS_LLT	EBC2_ELT vs. LOS_ELT	EBC2_LLT vs. LOS_LLT
Red	0 (0%)	2 (4%)	-2 (-10%)	-6 (-13%)
Orange	-5 (-38%)	2 (15%)	0 (0%)	8 (62%)
Yellow	-1 (-4%)	-4 (-33%)	2 (8%)	-1 (-8%)
None	6 (27%)	0 (0%)	0 (0%)	-1 (-11%)

[a] For definitions of levels of concern, see Section 5C.4, Table 5C.4-4.

Degree-days exceeding 56°F at Bend Bridge and Red Bluff were summed by month and water-year type during May through September and October through April, respectively. Results each model scenario at Bend Bridge are presented in Table 5C.5.2-34 differences between EBC and ESO model scenarios in degree-days are presented in Table 5C.5.2-35. As reported above, overall, there would be negligible increases in degree-days above the threshold that are not expected to cause biologically meaningful effects to spring-run Chinook salmon spawning and egg incubation at Bend Bridge.

Results for Red Bluff for each model scenario are presented in Table 5C.5.2-45 and differences between model scenarios in degree-days are presented in Table 5C.5.2-46. There would be no exceedances above 56°F December through February under any scenario. In the ELT, during October, November, and April, degree-days exceeding the threshold under the ESO would be higher and lower than those under EBC2 depending on month and water-year type. During March, the total exceedance under ESO_ELT would be 11 degree-days more than exceedances under EBC2_ELT. The effect of this increase on spring-run Chinook salmon is uncertain, although it translates into the equivalent of 11 days in all Marches combined during the 82-year period on which temperatures would be 1°F higher than the threshold. Therefore, it is unlikely that this value has a biologically meaningful effect on spring-run Chinook salmon. In the LLT, there would be no differences in exceedances between EBC2 and ESO during November through March. In October, exceedances would be 318 degree-days (5%) higher under ESO than under EBC2. In April, exceedances would be 113 degree days (7%) lower under ESO than under EBC2. Overall, these results indicate that, in the LLT, there would generally be no difference in exceedances above the threshold, with some small increases and decreases in exceedances during shoulder months that may have small biologically meaningful effects in both directions (beneficial and adverse) on spring-run Chinook salmon spawning and egg incubation at Red Bluff. It should be noted that this calculation only includes days on which water temperatures would exceed the 56°F threshold and does not include days when water temperature would be below the threshold.

Differences between EBC2 scenarios and HOS and LOS scenarios model scenarios in degree-days are presented in Table 5C.5.2-47. The total monthly number of degree-days under HOS for all water-year types combined would generally be similar or up to 20% lower than the number under EBC2 depending on month, except during March, in which the number of degree-days under HOS_ELT and HOS_LLT would be 9 and 15 degree-days (16% and 10%, respectively) higher than under EBC2_ELT and EBC2_LLT, respectively. These differences in degree-days across the 82-year period would not likely have a biologically meaningful effect on spring-run Chinook salmon. Similarly, number of degree-days under LOS would generally be similar or up to 13% lower than the number under EBC2 depending on month, except during March, in which the number of degree-days under HOS_ELT and HOS_LLT would be 6 and 12 degree-days (11% and 5%, respectively) higher than under EBC2_ELT and EBC2_LLT, respectively. These differences in degree-days across the 82-year period would not likely have a biologically meaningful effect on spring-run Chinook salmon. These results indicate that, using this approach, there would be no effect or a small benefit of HOS and LOS to water-temperature-related habitat for spring-run Chinook salmon at Red Bluff durig October through April.

Table 5C.5.2-45. Total Degree-Days (°F-Days) by Month and Water-Year Type for Water Temperature Exceedances above 56°F in the Sacramento River at Red Bluff, October through April

Month	Water-Year Type	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Oct	W	257	315	679	1426	699	1519	663	1518	645	1341
	AN	260	315	457	737	469	774	451	758	441	712
	BN	209	222	467	915	455	1007	438	906	430	894
	D	491	507	865	1562	894	1655	777	1535	871	1509
	C	600	602	1015	1523	957	1526	801	1427	925	1459
	All	1817	1961	3483	6163	3474	6481	3130	6144	3312	5915
Nov	W	1	1	9	91	10	97	8	95	10	73
	AN	0	0	3	61	4	67	4	71	3	64
	BN	0	0	2	48	2	52	1	45	2	41
	D	8	8	50	159	45	167	39	153	42	147
	C	4	4	22	114	24	106	17	92	18	102
	All	13	13	86	473	85	489	69	456	75	427
Dec	W	0	0	0	0	0	0	0	0	0	0
	AN	0	0	0	0	0	0	0	0	0	0
	BN	0	0	0	0	0	0	0	0	0	0
	D	0	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0	0
	All	0	0	0	0	0	0	0	0	0	0
Jan	W	0	0	0	0	0	0	0	0	0	0
	AN	0	0	0	0	0	0	0	0	0	0
	BN	0	0	0	0	0	0	0	0	0	0
	D	0	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0	0
	All	0	0	0	0	0	0	0	0	0	0

Month	Water-Year Type	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Feb	W	0	0	0	0	0	0	0	0	0	0
	AN	0	0	0	0	0	0	0	0	0	0
	BN	0	0	0	0	0	0	0	0	0	0
	D	0	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0	0
	All	0	0	0	0	0	0	0	0	0	0
Mar	W	0	0	1	9	1	9	1	9	1	9
	AN	0	0	0	4	1	5	0	5	1	6
	BN	9	4	10	30	19	38	19	44	18	38
	D	14	12	34	78	35	78	34	79	31	77
	C	1	1	12	28	12	25	12	27	12	26
	All	24	17	57	149	68	155	66	164	63	156
Apr	W	115	116	212	376	216	375	212	377	212	374
	AN	140	129	212	369	217	344	208	345	219	342
	BN	79	98	173	309	166	308	178	334	161	309
	D	186	192	293	506	295	434	304	508	279	480
	C	12	18	54	163	52	149	61	143	53	147
	All	532	553	944	1723	946	1610	963	1707	924	1652

Table 5C.5.2-46. Differences between EBC and ESO Scenarios in Total Degree-Days (°F-Days) by Month and Water-Year Type for Water Temperature Exceedances above 56°F in the Sacramento River at Red Bluff, October through April

Month	Water-Year Type	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Oct	W	442 (172%)	1262 (491%)	384 (122%)	1204 (382%)	20 (3%)	93 (7%)
	AN	209 (80%)	514 (198%)	154 (49%)	459 (146%)	12 (3%)	37 (5%)
	BN	246 (118%)	798 (382%)	233 (105%)	785 (354%)	-12 (-3%)	92 (10%)
	D	403 (82%)	1164 (237%)	387 (76%)	1148 (226%)	29 (3%)	93 (6%)
	C	357 (60%)	926 (154%)	355 (59%)	924 (153%)	-58 (-6%)	3 (0.2%)
	All	1657 (91%)	4664 (257%)	1513 (77%)	4520 (230%)	-9 (-0.3%)	318 (5%)
Nov	W	9 (900%)	96 (9600%)	9 (900%)	96 (9600%)	1 (11%)	6 (7%)
	AN	4 (NA)	67 (NA)	4 (NA)	67 (NA)	1 (33%)	6 (10%)
	BN	2 (NA)	52 (NA)	2 (NA)	52 (NA)	0 (0%)	4 (8%)
	D	37 (463%)	159 (1988%)	37 (463%)	159 (1988%)	-5 (-10%)	8 (5%)
	C	20 (500%)	102 (2550%)	20 (500%)	102 (2550%)	2 (9%)	-8 (-7%)
	All	72 (554%)	476 (3662%)	72 (554%)	476 (3662%)	-1 (-1%)	16 (3%)
Dec	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)

Month	Water-Year Type	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
Feb	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
Mar	W	1 (NA)	9 (NA)	1 (NA)	9 (NA)	0 (0%)	0 (0%)
	AN	1 (NA)	5 (NA)	1 (NA)	5 (NA)	1 (NA)	1 (25%)
	BN	10 (111%)	29 (322%)	15 (375%)	34 (850%)	9 (90%)	8 (27%)
	D	21 (150%)	64 (457%)	23 (192%)	66 (550%)	1 (3%)	0 (0%)
	C	11 (1100%)	24 (2400%)	11 (1100%)	24 (2400%)	0 (0%)	-3 (-11%)
	All	44 (183%)	131 (546%)	51 (300%)	138 (812%)	11 (19%)	6 (4%)
Apr	W	101 (88%)	260 (226%)	100 (86%)	259 (223%)	4 (2%)	-1 (-0.3%)
	AN	77 (55%)	204 (146%)	88 (68%)	215 (167%)	5 (2%)	-25 (-7%)
	BN	87 (110%)	229 (290%)	68 (69%)	210 (214%)	-7 (-4%)	-1 (-0.3%)
	D	109 (59%)	248 (133%)	103 (54%)	242 (126%)	2 (1%)	-72 (-14%)
	C	40 (333%)	137 (1142%)	34 (189%)	131 (728%)	-2 (-4%)	-14 (-9%)
	All	414 (78%)	1078 (203%)	393 (71%)	1057 (191%)	2 (0.2%)	-113 (-7%)

Table 5C.5.2-47. Differences between EBC2 Scenarios and HOS and LOS Scenarios in Total Degree-Days (°F-Days) by Month and Water-Year Type for Water Temperature Exceedances above 56°F in the Sacramento River at Red Bluff, October through April

Month	Water-Year Type	EBC2_ELT vs. HOS_ELT	EBC2_LLT vs. HOS_LLT	EBC2_ELT vs. LOS_ELT	EBC2_LLT vs. LOS_LLT
Oct	W	-16 (-2%)	92 (6%)	-34 (-5%)	-85 (-6%)
	AN	-6 (-1%)	21 (3%)	-16 (-4%)	-25 (-3%)
	BN	-29 (-6%)	-9 (-1%)	-37 (-8%)	-21 (-2%)
	D	-88 (-10%)	-27 (-2%)	6 (1%)	-53 (-3%)
	C	-214 (-21%)	-96 (-6%)	-90 (-9%)	-64 (-4%)
	All	-353 (-10%)	-19 (-0.3%)	-171 (-5%)	-248 (-4%)
Nov	W	-1 (-11%)	4 (4%)	1 (11%)	-18 (-20%)
	AN	1 (33%)	10 (16%)	0 (0%)	3 (5%)
	BN	-1 (-50%)	-3 (-6%)	0 (0%)	-7 (-15%)
	D	-11 (-22%)	-6 (-4%)	-8 (-16%)	-12 (-8%)
	C	-5 (-23%)	-22 (-19%)	-4 (-18%)	-12 (-11%)
	All	-17 (-20%)	-17 (-4%)	-11 (-13%)	-46 (-10%)

Month	Water-Year Type	EBC2_ELT vs. HOS_ELT	EBC2_LLT vs. HOS_LLT	EBC2_ELT vs. LOS_ELT	EBC2_LLT vs. LOS_LLT
Dec	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)	0 (NA)	0 (NA)
Jan	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)	0 (NA)	0 (NA)
Feb	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)	0 (NA)	0 (NA)
Mar	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (NA)	1 (25%)	1 (NA)	2 (50%)
	BN	9 (90%)	14 (47%)	8 (80%)	8 (27%)
	D	0 (0%)	1 (1%)	-3 (-9%)	-1 (-1%)
	C	0 (0%)	-1 (-4%)	0 (0%)	-2 (-7%)
	All	9 (16%)	15 (10%)	6 (11%)	7 (5%)
Apr	W	0 (0%)	1 (0.3%)	0 (0%)	-2 (-1%)
	AN	-4 (-2%)	-24 (-7%)	7 (3%)	-27 (-7%)
	BN	5 (3%)	25 (8%)	-12 (-7%)	0 (0%)
	D	11 (4%)	2 (0.4%)	-14 (-5%)	-26 (-5%)
	C	7 (13%)	-20 (-12%)	-1 (-2%)	-16 (-10%)
	All	19 (2%)	-16 (-1%)	-20 (-2%)	-71 (-4%)

The Reclamation egg mortality model was run to predict the effects of changes to water temperature under the ESO relative to EBC scenarios on spring-run egg mortality. Results are presented in Table 5C.5.2-48. Egg mortality is predicted to increase through time (EBC2 vs. EBC2_ELT vs. EBC2_LLT), but would not change (<5% difference) due to the ESO, except in below normal water years (7% higher in ELT and 12% higher in LLT). Averaging across water-year types, egg mortality is predicted to be similar between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. The small increase in egg mortality in below normal years is not expected to affect spring-run at a population level because there are no effects of the ESO in other water year types.

Table 5C.5.2-48. Egg Mortality Percentages for Spring-Run Chinook in the Mainstem Sacramento River under EBC and ESO Scenarios

Water-Year Type	Scenario[a]					
	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Wet	10.1	8.9	14.0	24.8	14.2	27.6
Above Normal	13.2	9.8	16.0	35.0	20.1	38.9
Below Normal	11.9	11.8	21.1	41.3	27.9	53.4
Dry	19.7	22.5	40.7	76.4	42.1	73.7
Critical	73.9	71.2	92.1	96.3	92.7	96.2
All	22.4	21.8	33.0	51.1	35.2	54.0

Source: Reclamation egg mortality model.
[a] See Table 5C.0-1 for definitions of the scenarios.

The SacEFT model classifies egg incubation conditions (Egg-to-Fry Thermal Mortality in SacEFT documentation, Attachment 5C.B, *Sacramento River Ecological Flows Tool (SacEFT): Record of Design (v.2.00)*) asgood in 86% of years for EBC1, 85% of years for EBC2, 65% for EBC2_ELT, and 58% for ESO_ELT, suggesting an overall decline in conditions attributable to future climate change, and a small (7% on an absolute scale, 11% on a relative scale) decline under the ESO_ELT relative to EBC2_ELT (Table 5C.5.2-41). In addition, egg incubation conditions are classified as good in 34% of years for EBC2_LLT, and 22% for ESO_LLT, a decrease of 12% in the percent of good years (35% on a relative scale). Therefore, the greatest effect on conditions for spring-run salmon egg incubation would come from future climate change, although the ESO is predicted to adversely affect spring-run eggs, as well.

There is an apparent discrepancy in results of the SacEFT model and Reclamation egg mortality model with regard to conditions for spring-run salmon eggs. SacEFT predicts that egg incubation habitat would decrease (7% and 12% decreases in ELT and LLT, respectively) and the Reclamation egg mortality model predicts that overall egg mortality would be unaffected by the ESO, except in below normal water years. The SacEFT uses mid-August through early March as the egg incubation period, based on Vogel and Marine (1991), and the reach between ACID Dam and Battle Creek for redd locations. The Reclamation egg mortality model uses the number of days after Julian week 33 (mid-August) that it takes to accumulate 750 temperature units to hatching and another 750 temperature units to emergence. Temperatures units are calculated by subtracting 32°F from daily river temperature and are computed on a daily basis. As a result, egg incubation duration is generally mid-August through January, but is dependent on river temperature. The Reclamation model uses the reach between ACID Dam and Jelly's Ferry (approximately 5 river miles downstream of Battle Creek), which includes 95% of Sacramento River spawning locations based on 2001–2004 redd survey data (Bureau of Reclamation 2008). These differences in egg incubation period and location likely account for the difference between model results. Although the SacEFT model has been peer-reviewed, the Reclamation egg mortality model has been extensively reviewed and used in prior biological assessments and BiOps. Therefore, both results are considered valid and were considered in drawing conclusions about spring-run egg mortality in the Sacramento River.

Redd Dewatering

The risk of redd dewatering in the mainstem Sacramento River is a function of river flow during spawning and subsequent flow reductions during the egg incubation period. The SacEFT model classifies the risk of redd dewatering as good (reduced risk of adverse effects) in 49% of years for EBC1, 37% for EBC2, 41% for EBC2_ELT and 39% for ESO_ELT (Table 5C.5.2-41). The SacEFT model classifies the risk of redd dewatering as good in 34% of years for EBC2_LLT and 32% for ESO_LLT. These results indicate that there would be a negligible effect (2% lower) of the ESO on redd dewatering under future climate conditions. Further, there is no consistent influence of future climate change on redd dewatering risk.

5C.5.2.1.3.2 Fry and Juvenile Rearing

Rearing Habitat

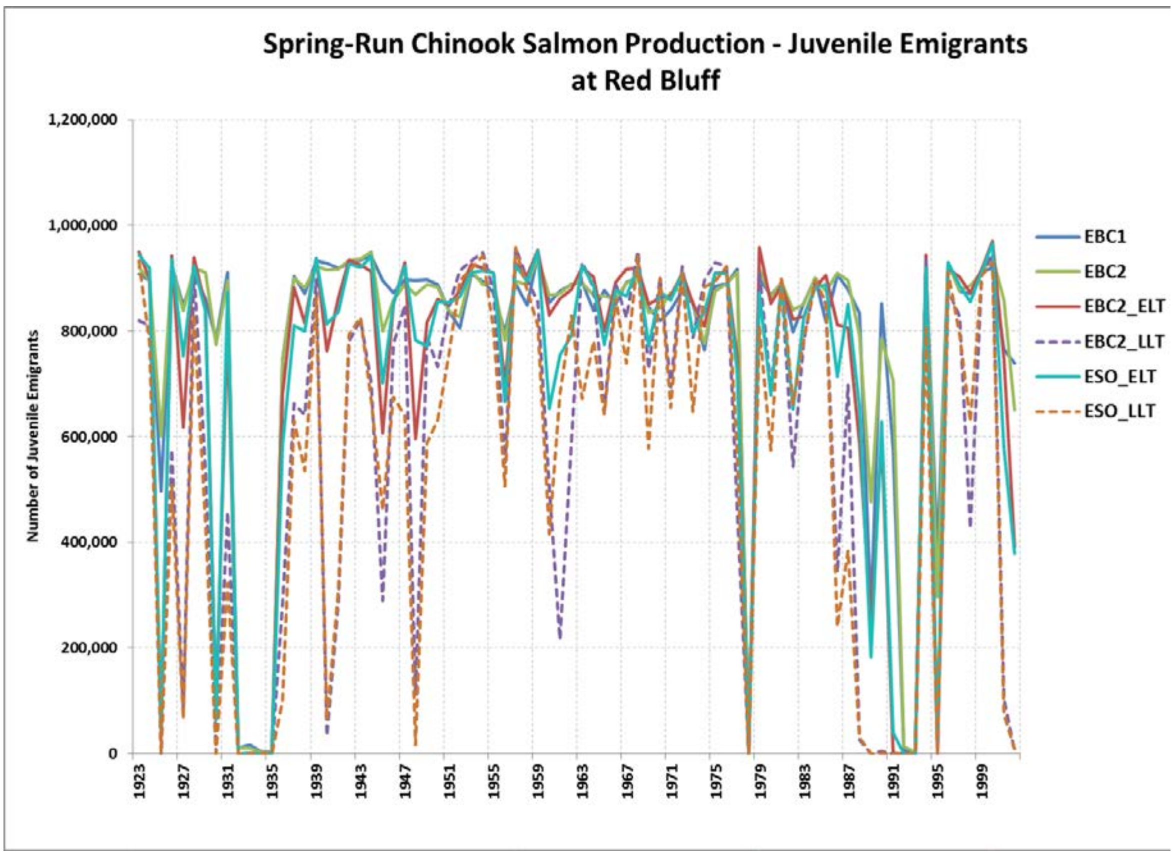
The primary seasonal period for juvenile spring-run Chinook salmon rearing in the Sacramento River extends from November through March, based on Knights Landing screw trap data from 1995–2000 (Snider and Titus 1998, 2000a, 2000b, 2000c). Upper Sacramento River flows between Keswick and RBDD during this period are generally similar between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT, indicating that the ESO generallyt does not affect flow rates in the Sacramento River (Table 5C.5.2-1 through Table 5C.5.2-4; Figure 5C.5.2-1 through Figure 5C.5.2-24). One exception is during November, in which flows would be 5% to 23% lower under the ESO than EBC2 depending on water-year type and implementation period. This reduction is not expected to affect spring-run in a biologically meaningful way, which is further confirmed by the similarity between EBC2 and ESO in the frequency meeting NMFS minimum flow thresholds in the Sacramento River (Table 5C.5.2-10 and Table 5C.5.2-11). As discussed above, flows would be further reduced under LOS_LLT during November; however, because it occurs in only one of five months during the fry and juvenile rearing period, this reduction would not affect spring-run Chinook salmon in a biologically meaningful way.

As reported above, there would be very small (<2%) differences in water temperature in the Sacramento River at Keswick or Bend Bridge in all months and water-year types between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT (Table 5C.5.2-15 through Table 5C.5.2-18). The largest change in average temperature would be an increase of 0.1°F, or 1.7%, which would occur at Bend Bridge in below normal water years during September. Further, there would be no meaningful differences in Sacramento River water temperatures between the ESO scenario and HOS and LOS scenarios (Table 5C.5.2-19, Table 5C.5.2-20, Table 5C.5.2-21, Table 5C.5.2-22). Overall, these results indicate that water temperatures during the year-round spring-run juvenile rearing period will not be affected by the ESO, HOS, or LOS.

Potential flow and temperature effects on juvenile spring-run rearing habitat were modeled using SacEFT. The SacEFT model classifies juvenile rearing habitat as good in 22% and 23% of years under EBC1 and EBC2, respectively (Table 5C.5.2-41). The model classifies juvenile rearing habitat as good in 25% for EBC2_ELT, 28% of years for ESO_ELT, 22% of years for EBC2_LLT, and 26% of years for ESO_LLT. These results suggest that juvenile rearing conditions under ESO_ELT and ESO_LLT would be comparable to conditions under EBC2_ELT and EBC2_LLT, respectively. The frequency of years in which SacEFT predicts good habitat for juvenile spring-run salmon rearing is approximately one-quarter of the years under all model scenarios. The relatively low frequency of good years for juvenile rearing reflects seasonal hydrologic conditions and operations in the mainstem Sacramento River and is expected to result in reduced survival and abundance of spring-run Chinook salmon under all model scenarios.

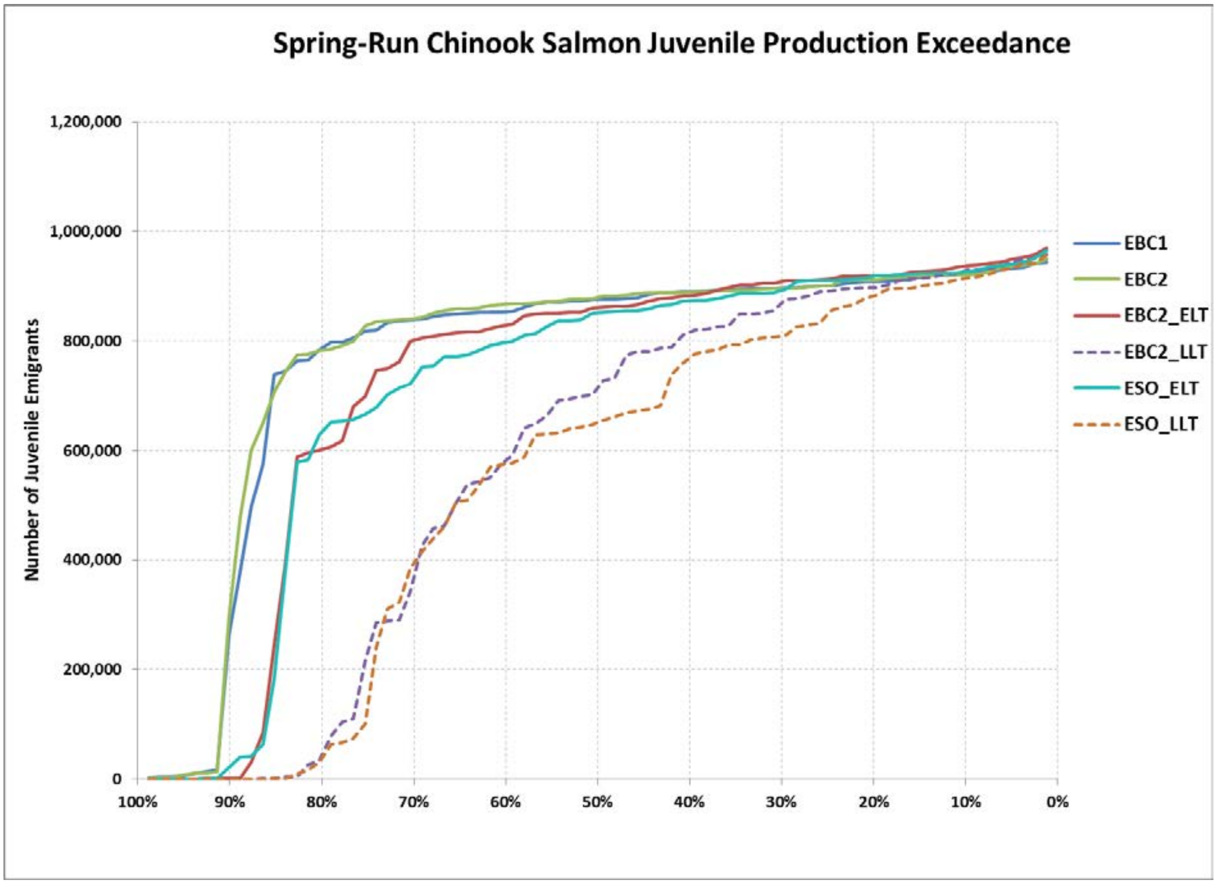
Juvenile spring-run Chinook salmon are potentially vulnerable to stranding in backwater and channel margin areas when instream flows are rapidly reduced during the rearing period. The risk of juvenile stranding was evaluated using SacEFT. Modeled risk of stranding for EBC1 and EBC2 is classified as good (reduced risk) in 19% and 18% of years, respectively (Table 5C.5.2-41). The frequency of years classified as good for reduced stranding conditions is predicted to be 20% for EBC2_ELT and ESO_ELT. The frequency of years classified as having good conditions is predicted to be 14% for EBC2_LLT and 12% for ESO_LLT. These results indicate that stranding risk would not be affected by the ESO in either implementation period.

The SALMOD model was used to evaluate the influence of both water temperature and instream flow on spring-run Chinook salmon under each model scenario. Spring-run Chinook salmon SALMOD runs used an adult escapement value of 1,001 individuals. Although recent average escapement values have been lower than this (Azat 2012), SALMOD will not provide accurate results for populations under 500. Therefore, a starting population of 1,001 adults was used to allow the model to function properly. Figure 5C.5.2-35 and Figure 5C.5.2-36 present a time series and exceedance plot, respectively, of production for each model scenario. SALMOD predicts that the spring-run production under ESO_ELT and ESO_LLT would be similar to (<5% difference) production under EBC2_ELT and EBC2_LLT, respectively.



Note: All life stages are combined and converted to smolt equivalents, with a fixed escapement (1,001 adults).

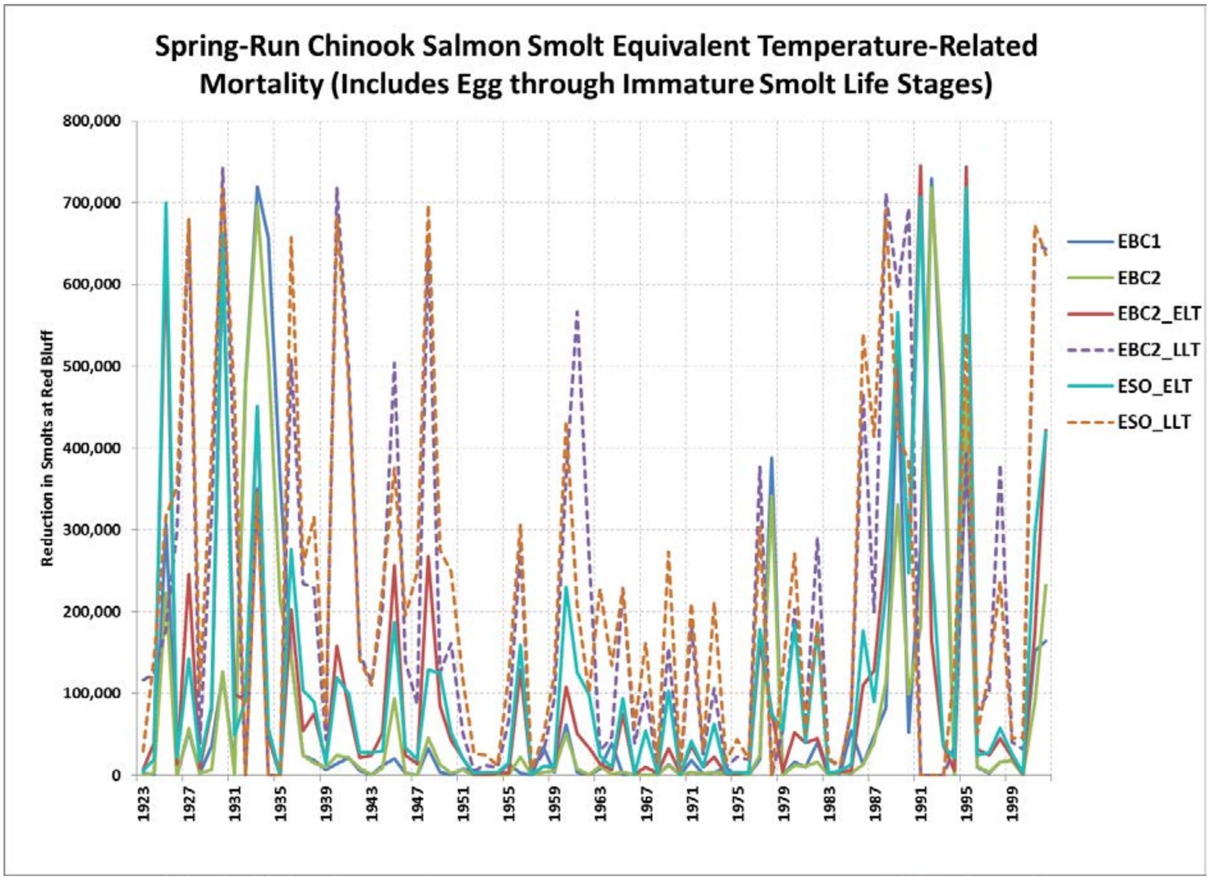
Figure 5C.5.2-35. Spring-Run Chinook Salmon Production at Red Bluff Diversion Dam under EBC and ESO Scenarios (SALMOD Model)



Note: All life stages are combined and converted to smolt equivalents.

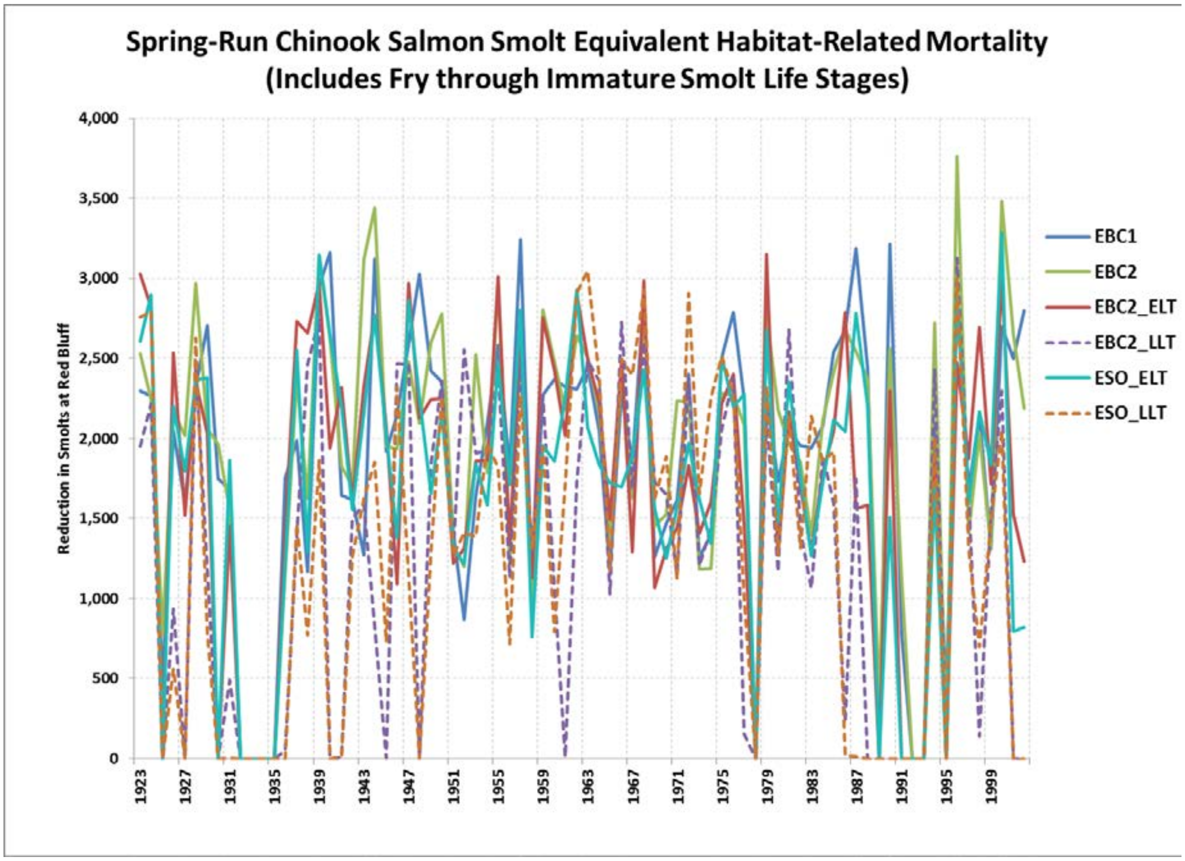
Figure 5C.5.2-36. Spring-Run Chinook Salmon Production Exceedance at Red Bluff Diversion Dam under EBC and ESO Scenarios (SALMOD Model)

Spring-run Chinook salmon spawn during the early fall (September–October) when Shasta Reservoir water temperatures released into the river are considered suboptimal for egg incubation. Smolt-equivalent temperature-related and habitat-related mortality through time from SALMOD is shown in Figure 5C.5.2-37 and Figure 5C.5.2-38, respectively. Figure 5C.5.2-39 and Figure 5C.5.2-40 display exceedance plots of temperature-related and habitat-related mortality, respectively. Temperature-related mortality would be increased from existing, to early long-term to late long-term climate conditions. There would be small (8% and 11%) increases in mean temperature-related mortality between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT, respectively. Habitat-related mortality would be very low relative to temperature related mortality. Habitat-related mortality would decline from existing to early long-term to late long-term climate conditions. There are no effects of the ESO on habitat-related mortality.



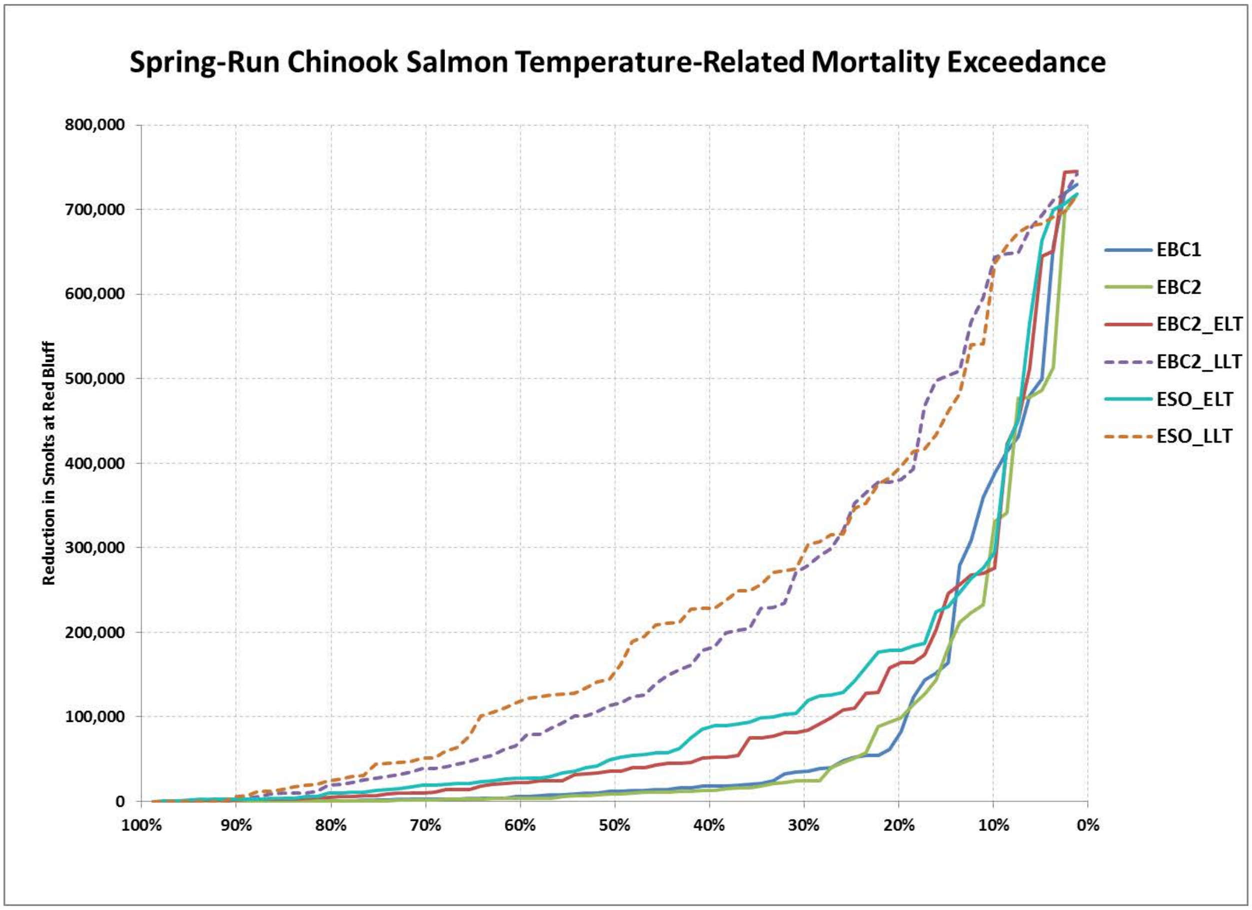
Note: All life stages are combined and converted to smolt equivalents.

Figure 5C.5.2-37. Spring-Run Chinook Salmon Temperature-Related Mortality (Egg through Smolt) under EBC and ESO Scenarios (SALMOD Model)



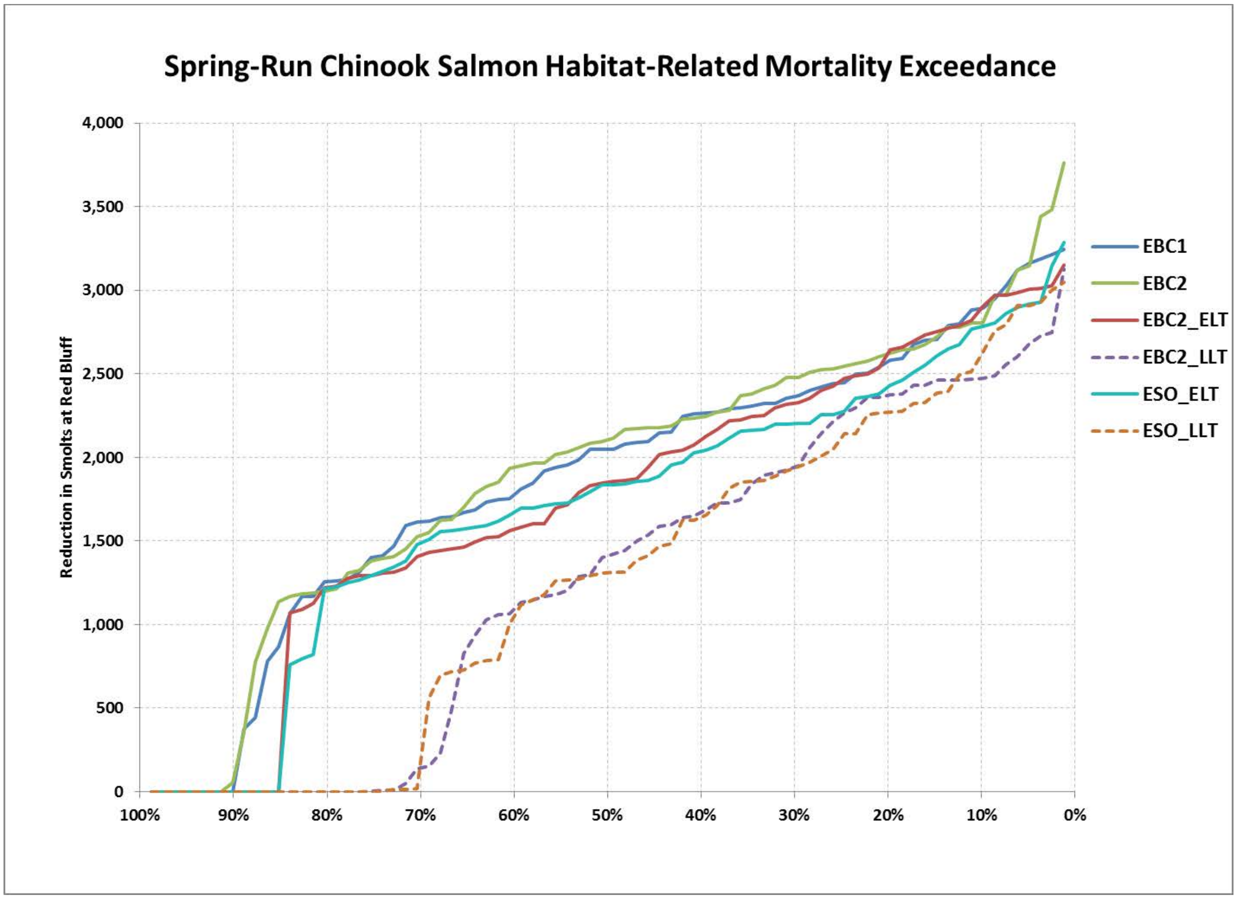
Note: All life stages are combined and converted to smolt equivalents.

Figure 5C.5.2-38. Spring-Run Chinook Salmon Habitat-Related Mortality (Fry through Smolt) under EBC and ESO Scenarios (SALMOD Model)



Note: All life stages are combined and converted to smolt equivalents.

Figure 5C.5.2-39. Spring-Run Chinook Salmon Temperature-Related Mortality (Egg through Smolt) Exceedance under EBC and ESO Scenarios (SALMOD Model)



Note: All life stages are combined and converted to smolt equivalents.

Figure 5C.5.2-40. Spring-Run Chinook Salmon Habitat-Related Mortality (Fry through Smolt) Exceedance under EBC and ESO Scenarios (SALMOD Model)

SALMOD-generated estimates of juvenile spring-run Chinook salmon production are summarized in Table 5C.5.2-49. These results indicate that minimum production would be 0 with and without the ESO during the ELT and LLT. Zero production years can be sustainable if they are rare or are separated by productive years. However, zero production years for three to five consecutive years would be unsustainable to the population. An additional analysis of SALMOD production results indicates that there would be no periods in which there is zero production for three or more years under EBC1, EBC2, EBC2_ELT or ESO_ELT and two periods under EBC2_LLT and ESO_LLT, 1932–1935 and 1991–1993. This is due to climate change only and not the ESO. Mean production is reduced from EBC2 to EBC2_ELT and from EBC2_ELT to EBC2_LLT. This same pattern exists between ESO_ELT and ESO_LLT. Differences between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT are negligible (<5% difference). Therefore, although temperature-related mortality would increase between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT (Figure 5C.5.2-37 and Figure 5C.5.2-39), the ESO would not alter overall production in a biologically meaningful way.

Table 5C.5.2-49. Spring-Run Chinook Salmon Juvenile Production Estimates for EBC and ESO Scenarios

Estimate	Scenario[a]					
	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Minimum	1,702	194	0	0	0	0
Maximum	944,184	950,778	970,006	957,400	966,132	957,447
Average	775,578	781,236	724,439	574,757	711,049	548,439
Change (Percent) from Average EBC2_ELT					-13,390 (-1.8%)	
Change (Percent) from Average EBC2_LLT						-26,318 (-4.6%)

Source: SALMOD.
[a] See Table 5C.0-1 for definitions of the scenarios.

A threshold value of <100,000 individuals was evaluated as a measure of the worst case scenario for the winter-run population. The number of years in which the juvenile production estimate was <100,000 individuals was calculated (Table 5C.5.2-50) and compared between model scenarios (Table 5C.5.2-51). These results indicate that there would be eleven years with juvenile production estimates lower than the 100,000 threshold under both EBC2_ELT and ESO_ELT, resulting in no difference between the scenarios. There would be two more years (12% higher) with juvenile production estimates lower than the 100,000 threshold under ESO_LLT compared to EBC2_LLT. However, it is unlikely that two more years under the threshold out of 82 years would cause a biologically meaningful effect on the population. Therefore, there would be no effect of ESO on the frequency of worst case scenario years for winter-run Chinook salmon juvenile production.

Table 5C.5.2-50. Number of Years during which Spring-Run Chinook Salmon Juvenile Production Estimates Are Lower than 100,000 Individuals for EBC and ESO Scenarios

Scenario[a]	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Number of Years	7	7	11	17	11	19

Source: SALMOD model.
[a] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-51. Differences between EBC and ESO Scenarios in Number of Years during which Spring - Run Chinook Salmon Juvenile Production Estimates Would Be Lower than 100,000 Individuals

Comparison[a]	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Difference	4 (57%)	12 (171%)	4 (57%)	12 (171%)	0 (0%)	2 (12%)

Source: SALMOD model.
[a] See Table 5C.0-1 for definitions of the scenarios.

5C.5.2.1.3.3 Adult

Water Temperature

Adult spring-run Chinook salmon migrate upstream into the mainstem Sacramento River during the spring months (March through August, with peak migration in April through May) and hold in the upper river reaches through the spring and early summer months (April through September) prior to spawning and egg incubation.

Predicted average water temperatures by month and water-year type for the Sacramento River at Keswick and Bend Bridge, representative adult holding sites in the upper Sacramento River, are presented in Table 5C.5.2-15 and Table 5C.5.2-16, respectively and differences between model scenarios are presented in Table 5C.5.2-17 and Table 5C.5.2-18, respectively. These results indicate that there would be very small (<2%) differences in year-round water temperatures in the Sacramento River at Keswick or Bend Bridge regardless of water-year type or month between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. Further, there would be no meaningful differences in Sacramento River water temperatures between the ESO scenario and HOS and LOS scenarios (Table 5C.5.2-19, Table 5C.5.2-20, Table 5C.5.2-21, Table 5C.5.2-22). Given these results, it was concluded that there would be no water temperature-related effects of the ESO, HOS, or LOS scenarios on spring-run adult migration and holding conditions. Therefore, it was determined that no further temperature-related biological analyses for spring-run Chinook salmon adult migration and holding conditions are necessary.

5C.5.2.1.4 Fall-Run/Late Fall–Run

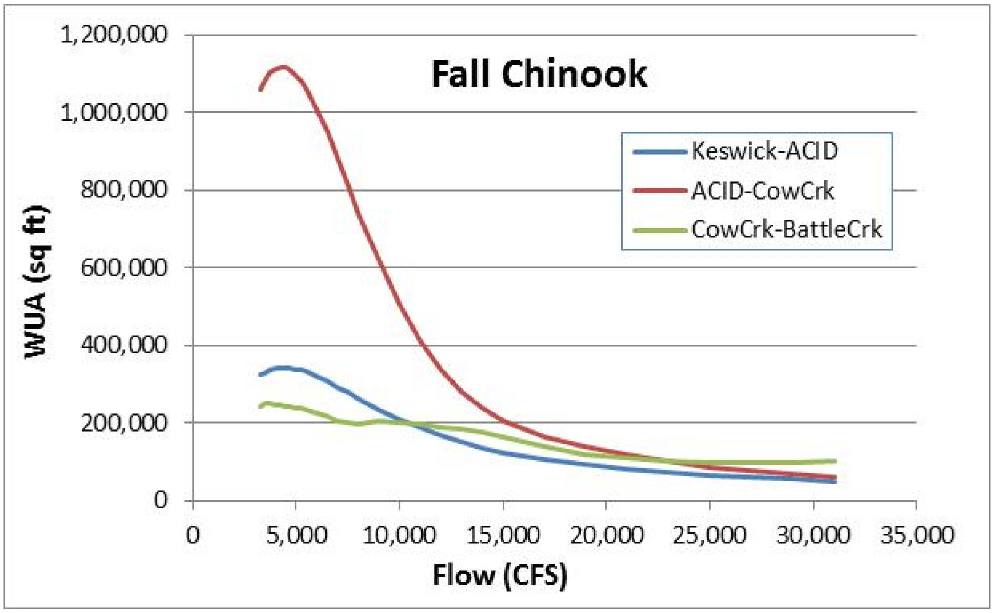
5C.5.2.1.4.1 Eggs and Alevins

Upstream Spawning Habitat

Mean monthly Sacramento River flows by month and water-year type at Keswick and RBDD during the fall-run Chinook salmon spawning and egg incubation period (September through March) are shown in Table 5C.5.2-1, Table 5C.5.2-3, Figure 5C.5.2-1, Figure 5C.5.2-10 through Figure 5C.5.2-12, Figure 5C.5.2-13, and Figure 5C.5.2-22 through Figure 5C.5.2-24. Results of instream flow modeling during the late fall–run Chinook salmon egg incubation period (December through June) are summarized in Table 5C.5.2-1, Table 5C.5.2-3, Figure 5C.5.2-2 through Figure 5C.5.2-5, and Figure 5C.5.2-14 through Figure 5C.5.2-17. Differences between pairs of model scenarios are presented by month and water-year type in Table 5C.5.2-2 and Table 5C.5.2-4. Instream flows and, therefore, physical habitat conditions were generally comparable between EBC and ESO operations for both races. One exception is during November in which be flows would be 5% to 23% lower than future EBC2 depending on location, water-year type, and implementation period, although the frequency of the reductions would not be high enough to cause a population level effect. Flows under HOS and LOS scenarios are generally similar to those under ESO during the September through March fall-run Chinook salmon spawning and egg incubation period with few exceptions (Table 5C.5.2-6 and Table 5C.5.2-8). As discussed above, none of the differences between the ESO scenario and HOS and LOS scenarios would cause population-level effects on fall-run or late fall–run Chinook salmon. These results suggest that there would be no effect of ESO, HOS, and LOS scenarios on flows during the fall-run or late fall–run Chinook salmon spawning and egg incubation periods.

Availability of suitable spawning habitat for fall-run and late fall–run Chinook salmon was evaluated using the SacEFT model. The empirical Flow-WUA relationship for fall-run Chinook is shown in Figure 5C.5.2-41. SacEFT classifies spawning habitat conditions for fall-run Chinook salmon as good in 48% and 43% of years under EBC1 and EBC2, respectively (Table 5C.5.2-52). SacEFT classifies spawning habitat conditions as good in 43% of years under EBC2_ELT and 57% of years under ESO_ELT, an increase of 14% on an absolute scale (33% on a relative scale). During the late long-term period, SacEFT classifies spawning habitat conditions as good in 35% of years under EBC2_LLT and 54% of years under ESO_LLT, an increase of 19% on an absolute scale (54% on a relative scale). These results show that, although flows are reduced in November (Table 5C.5.2-2, Table 5C.5.2-4), conditions are expected to improve (greater frequency of years with good habitat conditions) under

ESO operations in both the early and late long-term periods. For fall-run Chinook, improvements in Spawning WUA under the ESO scenarios are the result of the shape of the Flow-WUA relationship, which rises steeply at lower flows (Figure 5C.5.2-41). Combining all water-year types, mean flow during the fall-run spawning period declines by 5% in ESO_LLT, compared to EBC2_LLT. This results in a 7% improvement in spawning WUA for spawners in the ACID-CowCrk segment of the river, which translates to a 14% improvement in percent "good" years.



Source: U.S. Fish and Wildlife Service 2003: Figure 26; adapted for SacEFT.

Figure 5C.5.2-41. Spawning Weighted Usable Area (WUA) for Fall-Run Chinook Salmon in the Three River Segments Used by SacEFT Using Flow Data from Keswick (RM 301) and Cow Creek (RM280) (Historical or Simulated)

Table 5C.5.2-52. Percentage of Years Each Rating[a] from SacEFT for Fall-Run Chinook Salmon Habitat Metrics in the Upper Sacramento River under EBC and ESO Scenarios

Metric	Rating	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Spawning WUA	Good	48	43	43	35	57	54
	Worrisome	43	51	49	57	35	41
	Poor	9	6	8	8	8	5
Redd Scour Risk	Good	62	69	67	67	59	59
	Worrisome	4	3	3	5	7	8
	Poor	34	28	30	28	34	33
Egg Incubation	Good	94	94	89	69	89	69
	Worrisome	3	3	2	11	2	13
	Poor	3	3	9	20	9	18
Redd Dewatering Risk	Good	27	28	29	27	27	29
	Worrisome	11	9	12	12	13	14
	Poor	62	63	59	61	60	57

Metric	Rating	Scenario[b] EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Juvenile Rearing WUA	Good	33	35	38	40	34	38
	Worrisome	44	45	42	42	44	40
	Poor	23	20	20	18	22	22
Juvenile Stranding Risk	Good	31	25	23	20	23	22
	Worrisome	50	53	52	54	55	56
	Poor	19	22	25	26	22	22

[a] See Attachment 5C.B, *Sacramento River Ecological Flows Tool (SacEFT): Record of Design (v.2.00)*, for definition of "good", "worrisome", and "poor" for each performance measure.
[b] See Table 5C.0-1 for definitions of the scenarios.
WUA=Weighted Usable Area.

For late fall–run Chinook salmon, SacEFT predicts that spawning habitat would be good in 52% of the years under EBC1 and EBC2 (Table 5C.5.2-53). SacEFT classifies spawning habitat conditions as good in 48% of years under EBC_ELT and 45% under ESO_ELT, a reduction of 3%. Spawning habitat conditions are classified as good in 48% of years under both EBC2_LLT and ESO_LLT. A reduction of 3% in the early long-term periods is considered negligible and would not meaningfully affect late fall–run Chinook salmon spawning habitat.

Table 5C.5.2-53. Percentage of Years Each Rating[a] from SacEFT for Late Fall–Run Chinook Salmon Habitat Metrics in the Upper Sacramento River under EBC and ESO Scenarios

Metric	Rating	Scenario[b] EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Spawning WUA	Good	52	52	48	48	45	48
	Worrisome	21	26	27	21	29	23
	Poor	27	22	25	31	26	29
Redd Scour Risk	Good	83	84	81	77	80	77
	Worrisome	3	2	2	3	3	0
	Poor	14	14	17	20	17	23
Egg Incubation	Good	100	100	100	100	100	100
	Worrisome	0	0	0	0	0	0
	Poor	0	0	0	0	0	0
Redd Dewatering Risk	Good	62	60	56	57	56	59
	Worrisome	11	13	17	20	15	14
	Poor	27	27	27	23	29	27
Juvenile Rearing WUA	Good	45	45	57	63	43	42
	Worrisome	44	43	34	26	45	46
	Poor	11	12	9	11	12	12
Juvenile Stranding Risk	Good	72	68	60	46	51	42
	Worrisome	3	10	12	12	14	21
	Poor	25	22	28	42	35	37

[a] See Attachment 5C.B, *Sacramento River Ecological Flows Tool (SacEFT): Record of Design (v.2.00)*, for definition of "good", "worrisome", and "poor" for each performance measure.
[b] See Table 5C.0-1 for definitions of the scenarios.
WUA=Weighted Usable Area.

As reported in Table 5C.5.2-10 and Table 5C.5.2-11, the probability of exceeding the NMFS (2009, in prep.) year-round minimum threshold of 4,000 cfs to keep side channels flowing in the Sacramento River is nearly identical (<2% difference) between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. Further, there would be no reductions in the frequency of exceedance above the year-round 4,000 cfs threshold between HOS and LOS scenarios and the ESO scenario. This indicates that ESO, HOS, and LOS scenarios would have few, if any, effects on keeping sides wet in the Sacramento River for fall-run and late fall–run Chinook salmon spawning and egg incubation.

SacEFT model results were also used to evaluate redd scour risk as a result of high-flow exposure. For fall-run Chinook salmon, the percentage of years having good conditions (low risk of redd scour) was 62% and 69% under EBC1 and EBC2, respectively; 67% under EBC2_ELT, and EBC2_LLT; and 59% under ESO_ELT and ESO_LLT (Table 5C.5.2-52). These results suggest that there would be a small (8%) increase in the risk of redd scour during the fall-run Chinook salmon incubation period due to the ESO during both implementation periods.

For late fall–run Chinook salmon, SacEFT classifies redd scour risk during egg incubation as good (low risk) in 83% and 84% of years under EBC1 and EBC2, respectively, 81% of years under EBC2_ELT, 80% of years under ESO_ELT, and 77% of years under EBC2_LLT and ESO_LLT. These results indicate that the risk of late fall–run Chinook salmon redd scour during egg incubation would not be different under ESO relative to EBC2 in either the early and late long-term periods.

Water Temperature

Fall-run/late fall–run Chinook salmon spawning and egg incubation occurs primarily in the reach of the Sacramento River between Keswick Dam and RBDD. Fall-run salmon spawn in the late fall and early winter (September through January), when seasonal air temperatures in the Redding area are declining. The area of the river where suitable water temperatures occur for successful egg incubation depends on the temperature of water released to the river from Shasta and Keswick dams, the rate of instream flow, and atmospheric conditions that result in river warming as the water travels downstream. When coldwater storage in Shasta Reservoir is reduced, the amount of cold water available for release is reduced, and the temperature of the water at the point of release to the river is increased. Under these conditions, the length of river downstream of Keswick Dam that maintains suitable water temperatures for fall-run Chinook salmon egg incubation and hatching is reduced and eggs incubating in the downstream areas are exposed to increased water temperature and mortality.

Late fall–run Chinook salmon spawn during the late fall and early spring (November-April), when seasonal water temperatures have typically declined due to cooling daytime and nighttime atmospheric temperatures to levels that are suitable for egg incubation in the mainstem river.

Water temperature modeling (SRWQM) predicts that water temperatures in the Sacramento River at Keswick and Bend Bridge would not differ in any month or water-year type between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT (Table 5C.5.2-15, Table 5C.5.2-16, Table 5C.5.2-17, Table 5C.5.2-18). This indicates that there would be no temperature-related effects on fall-run or late fall–run Chinook salmon eggs and alevins in the Sacramento River. Further, mean monthly water temperatures in the Sacramento River throughout the year under the HOS and LOS scenarios would not differ from those under the ESO (Table 5C.5.2-19, Table 5C.5.2-20, Table 5C.5.2-21, Table 5C.5.2-22).

The exceedances of daily water temperatures above a 56°F threshold at Red Bluff during October through April requested by NMFS were used to evaluate the potential water temperature-related effects of BDCP on fall-run and late fall–run Chinook salmon spawning and egg incubation (Section 5C.4, Table 5C.4-3).

Table 5C.5.2-42, Table 5C.5.2-43, and Table 5C.5.2-44 present “level of concern” results for Red Bluff for EBC2, ESO, HOS, and LOS scenarios. As described for spring-run Chinook salmon, the number of years within each level of concern based on exceedances above the threshold would not differ in a biologically meaningful way between EBC2_ELT and ESO_ELT or between EBC2_LLT and ESO_LLT. Further, there would be no effect or a small benefit of HOS and LOS scenarios on water temperature conditions during the October through April period.

The total number of degree-days exceeding the 56°F water temperature threshold at Red Bluff under ESO_ELT and ESO_LLT during October through April would be higher than, lower than, and similar to the number under EBC2_ELT and EBC2_LLT, respectively, depending on month (Table 5C.5.2-45, Table 5C.5.2-46). Overall, these results indicate that, in both the ELT and LLT, there would generally be no difference in exceedances above the threshold, with some small increases and decreases in exceedances during shoulder months that may have small biologically meaningful effects on fall-run and late fall–run Chinook salmon spawning and egg incubation in the Sacramento River. It should be noted that this calculation only includes days on which water temperatures would exceed the 56°F threshold and does not include days when water temperature would be below the threshold.

The Reclamation salmon egg mortality model was used to estimate the change in fall-run and late fall–run temperature-related egg survival under the ESO over a wide range of hydrologic and environmental conditions. Egg mortality model results provide an important indicator regarding changes in habitat suitability for fall-run and late fall–run Chinook salmon spawning and successful egg incubation. Results of the fall-run Chinook salmon egg mortality estimates under each model scenario are summarized in Table 5C.5.2-54. Egg mortality increases during drier water years (dry and critical) in all model scenarios as a result of depleted coldwater pool storage in Shasta Reservoir and increased temperatures of water released to the mainstem Sacramento River during the fall-run salmon egg incubation period. Increased egg mortality in the future is expected as the result of increased effects of climate change on air and water temperatures and changes in expected future hydrologic conditions. Egg mortality is similar between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT.

Table 5C.5.2-54. Egg Mortality Percentages for Fall-Run Chinook in the Mainstem Sacramento River under EBC and ESO Scenarios

Water-Year Type	Scenario[a]					
	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Wet	9.8	9.9	13.5	19.4	13.7	20.6
Above Normal	10.9	10.5	14.9	22.0	15.9	23.1
Below Normal	10.6	10.8	15.5	21.8	17.2	23.8
Dry	14.5	15.0	21.7	31.2	21.3	31.4
Critical	28.7	28.6	34.2	38.1	33.9	37.6
All	13.9	14.1	18.9	25.6	19.3	26.4

Source: Reclamation egg mortality model.
[a] See Table 5C.0-1 for definitions of the scenarios.

The potential effects of the ESO on fall-run Chinook salmon egg incubation conditions in the mainstem Sacramento River were evaluated using results of SacEFT. The model classifies egg incubation conditions as good in 94% of the years under both EBC1 and EBC2 (Table 5C.5.2-52). During the early long-term period, the percentage of years classified as having good egg incubation temperatures declines to 89% under both EBC2_ELT and ESO_ELT. During the late long-term period, SacEFT classifies egg incubation as good in 69% of years under both EBC2_LLT and ESO_LLT. Consistent with Reclamation egg mortality model results, results of the SacEFT analysis indicate that there would be no difference in egg incubation conditions between EBC2 and ESO scenarios during both the early and late long-term periods. Instead, the large degradation in egg incubation conditions through time independent of the ESO suggest that climate change will have adverse effects on fall-run egg incubation.

Results of the Reclamation egg mortality model for late fall–run Chinook salmon are summarized in Table 5C.5.2-55. The model predicts that egg mortality would be low in all scenarios regardless of water-year type. Egg mortality is not predicted to increase during dry and critically dry water years as it would for other races of Chinook salmon. Water temperatures released to the mainstem Sacramento River during the late fall–run salmon incubation period are naturally cold. Increased egg mortality in the future is predicted as a result of climate change effects on air and water temperatures and changes in expected future hydrologic conditions. Egg mortality is predicted to be nearly identical under ESO_ELT and ESO_LLT relative to EBC2_ELT and EBC2_LLT, respectively, indicating that there would be no effect of the project on late fall–run egg mortality.

Table 5C.5.2-55. Egg Mortality Percentages for Late Fall–Run Chinook in the Mainstem Sacramento River under EBC and ESO Scenarios

	Scenario[a]					
Water-Year Type	**EBC1**	**EBC2**	**EBC2_ELT**	**EBC2_LLT**	**ESO_ELT**	**ESO_LLT**
Wet	2.0	2.2	3.7	6.2	3.6	5.9
Above Normal	2.5	2.4	4.3	7.0	3.7	6.1
Below Normal	1.5	1.7	3.2	5.5	3.3	6.0
Dry	2.6	2.7	4.5	7.4	4.4	6.9
Critical	2.0	2.0	3.2	4.8	3.2	4.7
All	2.1	2.2	3.8	6.3	3.7	6.0

Source: Reclamation egg mortality model.
[a] See Table 5C.0-1 for definitions of the scenarios.

The potential effects of the ESO on late fall–run Chinook salmon egg incubation conditions in the mainstem Sacramento River were evaluated using results of SacEFT. SacEFT classifies egg incubation conditions for late fall–run as good in 100% of years under all model scenarios and time periods (Table 5C.5.2-53). Thus, egg incubation conditions would be similarly favorable under all scenarios evaluated. The high frequency of good egg incubation temperatures for late fall–run Chinook salmon reflects the fact that spawning occurs during the winter months and eggs incubate during a period when natural seasonal water temperatures are cold and provide suitable conditions for egg incubation. Results indicating low overall egg mortality and no effect of the ESO on egg mortality are consistent between the egg mortality model and SacEFT.

Redd Dewatering

SacEFT classifies redd dewatering risk for fall-run Chinook salmon as good (reduced risk of redd dewatering) in 27% and 28% of years under EBC1 and EBC2, respectively, 29% of years under EBC2_ELT, and 27% of the years under ESO_ELT (Table 5C.5.2-52). Results during the late long-term period were similar, with good conditions predicted in 27% of years under EBC2_ELT and 29% of years under ESO_LLT. These results suggest that the risk of redd dewatering is similar among all model scenarios. The 2% differences in the risk of redd dewatering between EBC and ESO scenarios are not expected to affect the survival of incubating eggs or the abundance of juvenile salmon produced in the upper mainstem Sacramento River. The low estimated frequency of good conditions (27% to 29%) under both EBC2 and ESO reflects a high risk of redd dewatering for fall-run Chinook salmon that has population-level consequences, although this is independent of BDCP operations. Results also indicate that climate change would not affect redd dewatering risk for fall-run.

SacEFT classifies redd dewatering risk for late fall–run Chinook salmon as good in 62% and 60% of years under EBC1 and EBC2, respectively, 56% of years under both EBC2_ELT and ESO_ELT, 57% of the years under EBC2_LLT, and 59% of the years under ESO_ELT (Table 5C.5.2-53). These results indicate that the risk of redd dewatering for late fall–run Chinook salmon would be similar between EBC and ESO scenarios. Results also indicate that climate change would not affect redd dewatering risk for late fall–run.

5C.5.2.1.4.2 Fry and Juvenile Rearing

Rearing Habitat

The primary seasonal period for juvenile fall-run Chinook salmon rearing in the Sacramento River is during January through May. Juvenile late fall–run Chinook salmon rear in the upper Sacramento River from March through July. Sacramento River flows between Keswick and RBDD during the fall-run period are generally similar between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT, indicating that the ESO does not affect flow rates in the Sacramento River (Table 5C.5.2-1 through Table 5C.5.2-4; Figure 5C.5.2-1 through Figure 5C.5.2-5 and Figure 5C.5.2-13 through Figure 5C.5.2-17). Sacramento River flows between Keswick and RBDD during the March through July late fall–run period are generally similar between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT(Table 5C.5.2-1 through Table 5C.5.2-4, Figure 5C.5.2-1 through Figure 5C.5.2-24). However, the frequency of meeting year-round minimum flow standards for upstream species in the Sacramento River would not differ between EBC2 and ESO scenarios (Table 5C.5.2-10 and Table 5C.5.2-11). Flows under HOS and LOS scenarios would generally be similar to those under ESO during both rearing periods, with few exceptions. However, as discussed above, none of the differences between the ESO scenario and HOS and LOS scenarios would cause population-level effects on fall-run or late fall–run Chinook salmon. These results suggest that there would be no flow-related effects of ESO, HOS, and LOS model scenarios on fall-run or late fall–run Chinook salmon rearing habitat in the Sacramento River.

As reported above, there would be very small (<2%) differences in water temperature in the Sacramento River at Keswick or Bend Bridge in all months and water-year types between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT (Table 5C.5.2-15 through Table 5C.5.2-16). Further, water temperatures under HOS and LOS scenarios would be very similar to those under ESO Table 5C.5.2-21and Table 5C.5.2-22. These results indicate that water temperatures during the

January through May juvenile fall-run rearing period and the March through July late fall–run rearing period will not be affected by the ESO, HOS, or LOS.

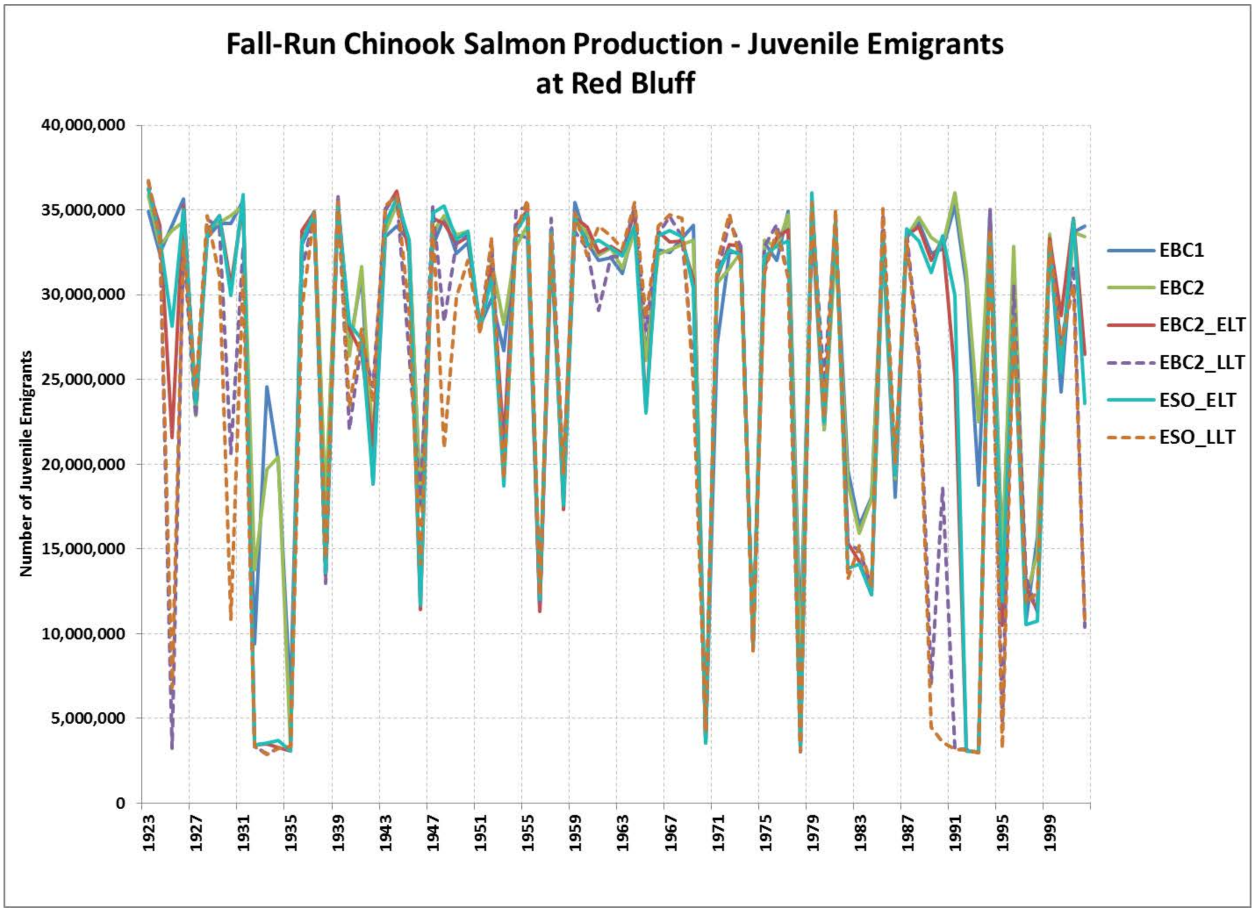
Potential flow and temperature effects on juvenile fall-run rearing habitat were modeled using SacEFT. SacEFT classifies habitat conditions for juvenile fall-run Chinook salmon rearing in the upper mainstem Sacramento River as good in 33% and 35% of years under EBC1 and EBC2, respectively, 38% under EBC2_ELT, 34% under ESO_ELT, 40% under EBC2_LLT, and 38% under ESO_LLT (Table 5C.5.2-52). These negligible (<5%) reductions are not expected to result in an effect of the ESO on available juvenile rearing habitat.

SacEFT classifies juvenile fall-run stranding risk as good (lower risk due to lower magnitude and frequency of flow fluctuations during the rearing period) in 31% and 25% of years under EBC1 and EBC2, respectively (Table 5C.5.2-52). SacEFT classifies stranding risk as good in 23% of years under EBC2_ELT and ESO_ELT. In the late long-term, SacEFT classifies stranding risk as good in 20% of years under EBC2_LLT and 22% of years under ESO_LLT. These negligible (<5%) reductions are not expected to result in an effect of the ESO on available juvenile rearing habitat.

Rearing habitat conditions for juvenile late fall–run Chinook salmon in the mainstem Sacramento River were also evaluated using SacEFT. SacEFT classifies juvenile rearing habitat as good in 45% of years under both EBC1 and EBC2 (Table 5C.5.2-53). During the early long-term period, the percentage of years having good juvenile rearing habitat conditions is predicted to be 57% under EBC2_ELT and 43% under ESO_ELT, a reduction of 14% due to the ESO. During the late long-term period, the percentage of years having good juvenile rearing habitat conditions is predicted to be 63% under EBC2_LLT and 42% under ESO_LLT, a reduction of 21% due to the ESO. Reducing the percentage of years with good juvenile rearing conditions is expected to contribute to a reduction in rearing habitat quantity, value, and availability for juvenile late fall–run Chinook salmon due to the ESO.

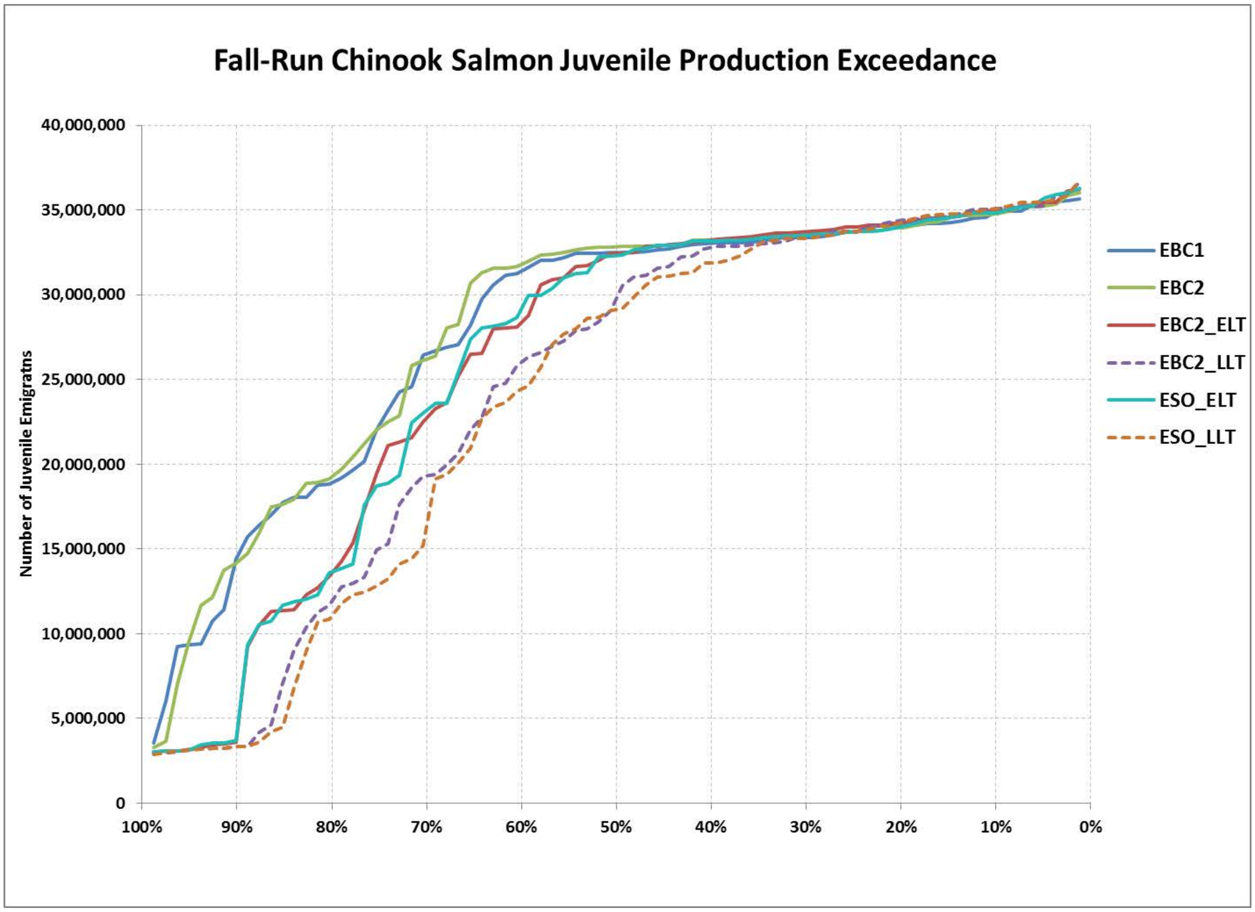
SacEFT also assessed the risk of stranding of juvenile late fall–run Chinook salmon in the Sacramento River resulting from rapid flow reductions. Good conditions (reduced risk of stranding) according SacEFT are predicted to occur in 72% and 68% of years under EBC1 and EBC2, respectively. During the early long-term period, the percentage of years that are classified as having good juvenile stranding conditions was 60% under EBC2_ELT and 51% under ESO_ELT, a reduction of 9%. During the late long-term period, the percentage of years with good juvenile stranding conditions was 46% under EBC2_LLT and 42% under ESO_LLT, a negligible difference of 4%. These results indicate that there is a small adverse effect of the ESO in the ELT on late fall–run juvenile stranding conditions in the upper Sacramento River, although effects of the ESO are negligible in the LLT.

The SALMOD model was used to evaluate potential changes in juvenile fall-run Chinook salmon rearing habitat in the Sacramento River. SALMOD used a fall-run adult escapement of 59,653 salmon (based on 1999–2006 escapement data from GrandTab 2008). The model predicts that production would be highest under EBC1 and EBC2, followed by EBC2_ELT and ESO_ELT (Figure 5C.5.2-43). Production would be lowest under EBC2_LLT and ESO_LLT. Differences between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT are predicted to be smaller than differences between implementation periods. These results suggest that reductions in future fall-run juvenile production are primarily due to changes in climate, increasing the magnitude and frequency of flow fluctuations, and minimally due to the BDCP.



Note: All life stages are combined and converted to smolt equivalents.

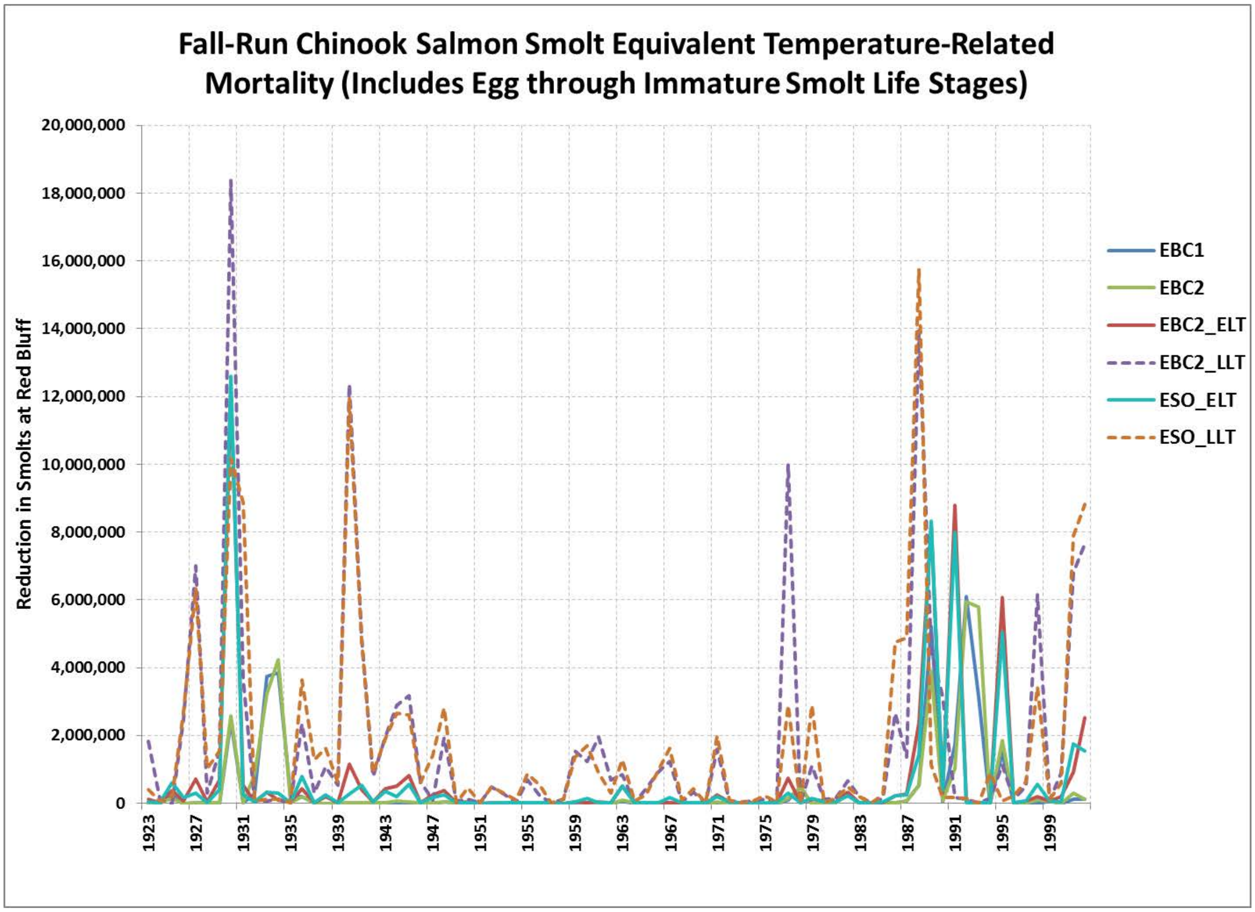
Figure 5C.5.2-42. Fall-Run Chinook Salmon Production at Red Bluff Diversion Dam under EBC and ESO Scenarios (SALMOD Model)



Note: All life stages are combined and converted to smolt equivalents.

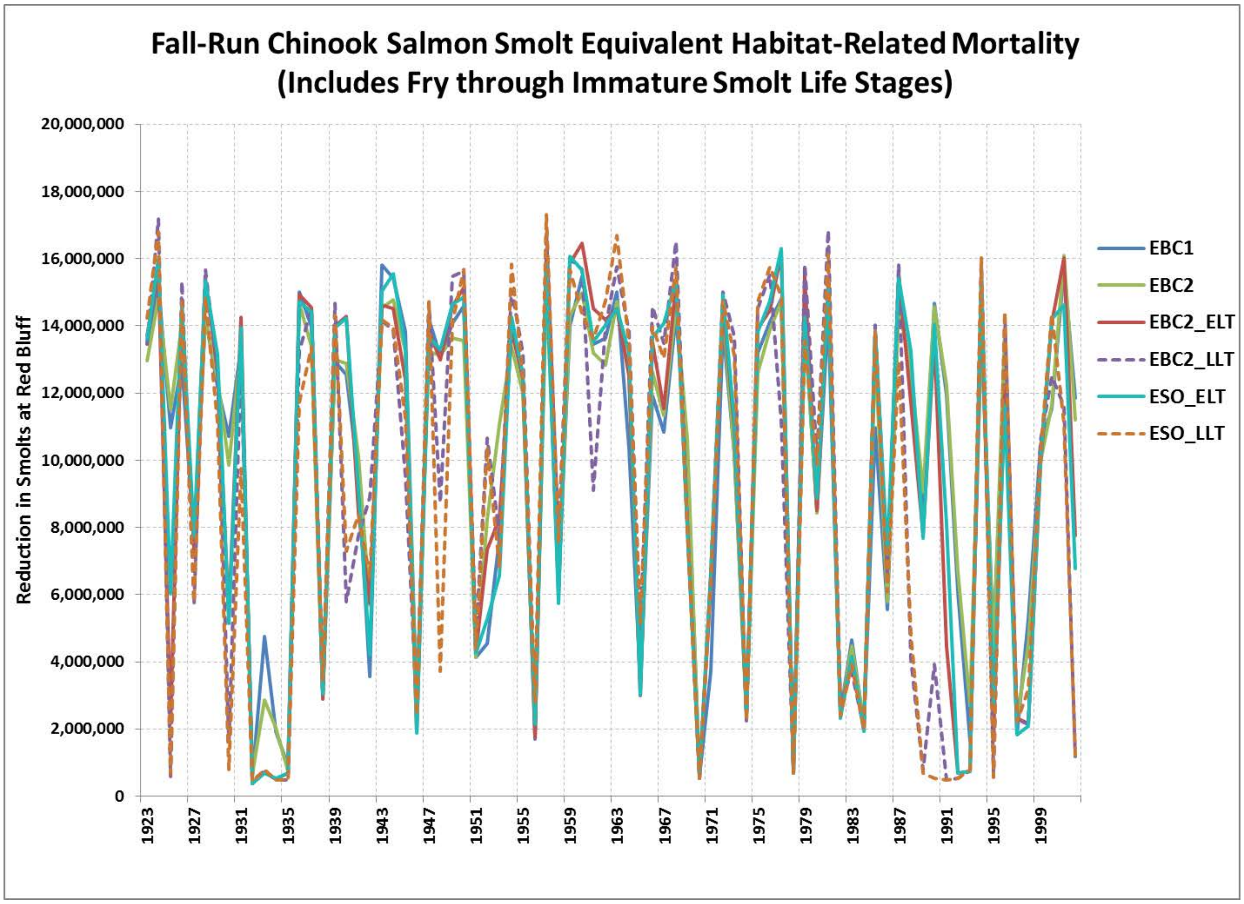
Figure 5C.5.2-43. Fall-Run Chinook Salmon Production Exceedance at Red Bluff Diversion Dam under EBC and ESO Scenarios (SALMOD Model)

Fall-run Chinook spawn during the fall, when water temperatures in releases from Shasta Reservoir can be suboptimal for egg incubation. Juvenile rearing occurs during the winter and spring when temperatures are cool. Smolt-equivalent temperature-related and habitat-related mortality through time is shown in Figure 5C.5.2-44 and, Figure 5C.5.2-45, respectively. Figure 5C.5.2-46 and Figure 5C.5.2-47 display exceedance plots of temperature-related and habitat-related mortality, respectively. Smolt-equivalent temperature-related mortality is predicted by SALMOD to increase through time (Figure 5C.5.2-44 and Figure 5C.5.2-46). However, there are no differences in temperature-related mortality due to the ESO in the late long-term period, but this effect is negligible compared to the effect of climate change. SALMOD predicts a slight reduction in smolt equivalent habitat-related mortality through time. However, there are negligible differences in habitat-related mortality predicted between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. These results suggest that habitat-related fall-run smolt mortality will decrease through time and, in the late long-term, will be further reduced by climate change rather than the ESO.



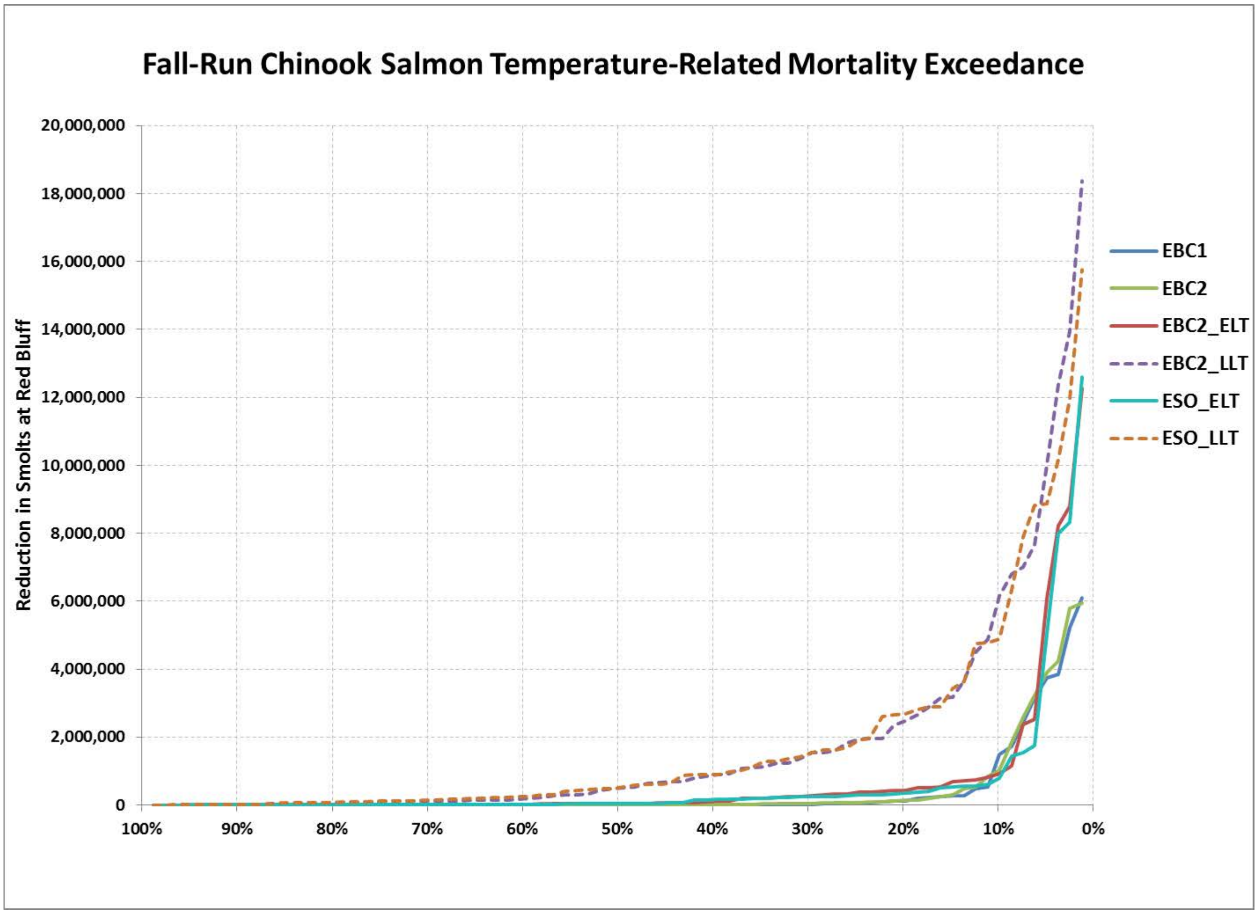
Note: All life stages are combined and converted to smolt equivalents.

Figure 5C.5.2-44. Fall-Run Chinook Salmon Temperature-Related Mortality (Egg through Smolt) under EBC and ESO Scenarios (SALMOD Model)



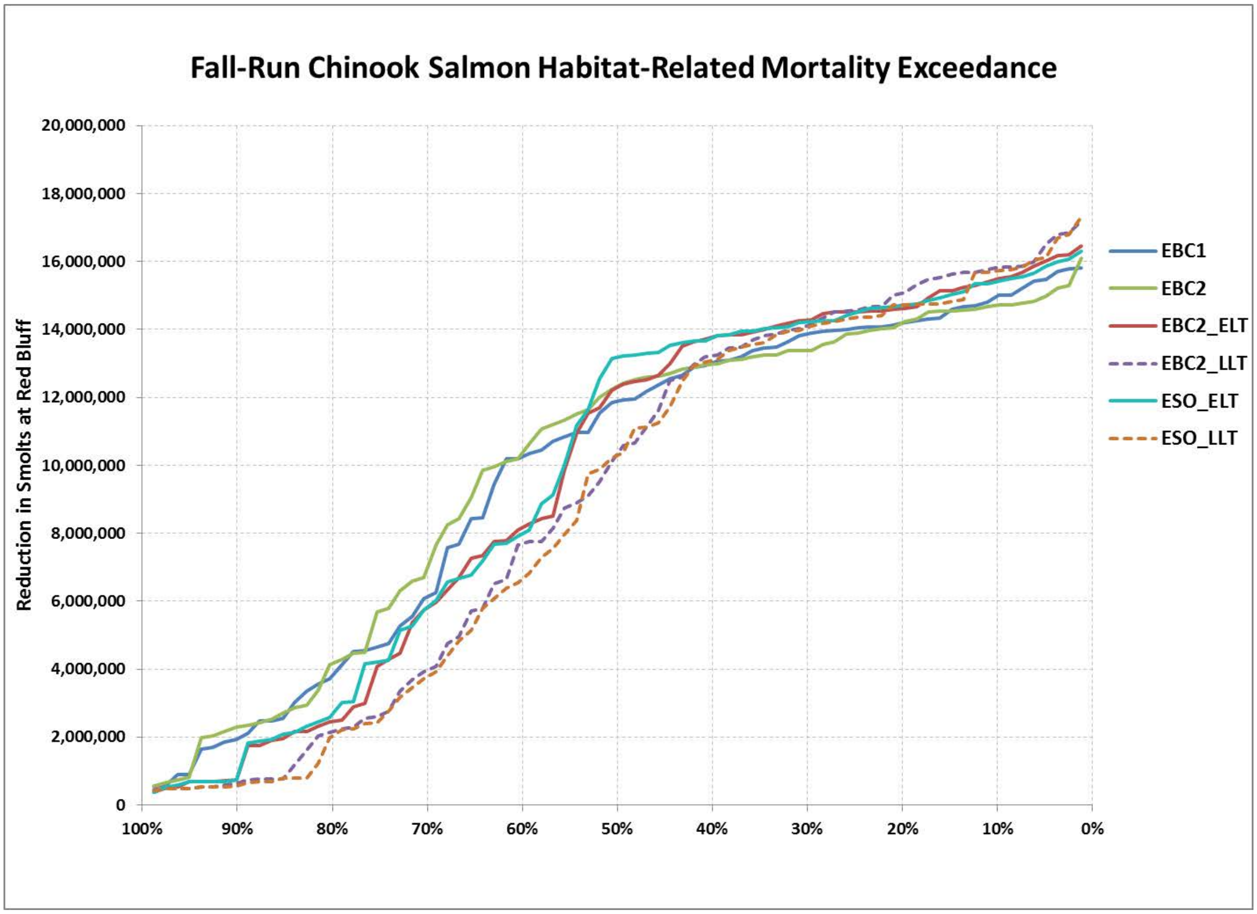
Note: All life stages are combined and converted to smolt equivalents.

Figure 5C.5.2-45. Fall-Run Chinook Salmon Habitat-Related Mortality (Fry through Smolt) under EBC and ESO Scenarios (SALMOD Model)



Note: All life stages are combined and converted to smolt equivalents.

Figure 5C.5.2-46. Fall-Run Chinook Salmon Temperature-Related Mortality (Egg through Smolt) Exceedance under EBC and ESO Scenarios (SALMOD Model)



Note: All life stages are combined and converted to smolt equivalents.

Figure 5C.5.2-47. Fall-Run Chinook Salmon Habitat-Related Mortality (Fry through Smolt) Exceedance under EBC and ESO Scenarios (SALMOD Model)

SALMOD-generated estimates of juvenile fall-run Chinook salmon production are summarized in Table 5C.5.2-56. These results reflect changes in habitat value and quantity based on habitat estimates each year over the 82-year CALSIM period and assume an adult escapement each year of 59,653 adult fall-run Chinook salmon (based on 1999–2006 escapement data from GrandTab 2008). The predicted production of juvenile fall-run Chinook salmon varies substantially among years (comparison of predicted minimum and maximum for each model scenario). Minimum, maximum, and average juvenile production model predictions were generally similar across model scenarios based on both the average annual and maximum production estimates. Average juvenile production would decrease through time. The 7% to 14% reductions due to climate change would be larger than the negligible (<5%) reductions due to the ESO. Therefore, SALMOD predicts that there would be no effects of the ESO on juvenile fall-run production.

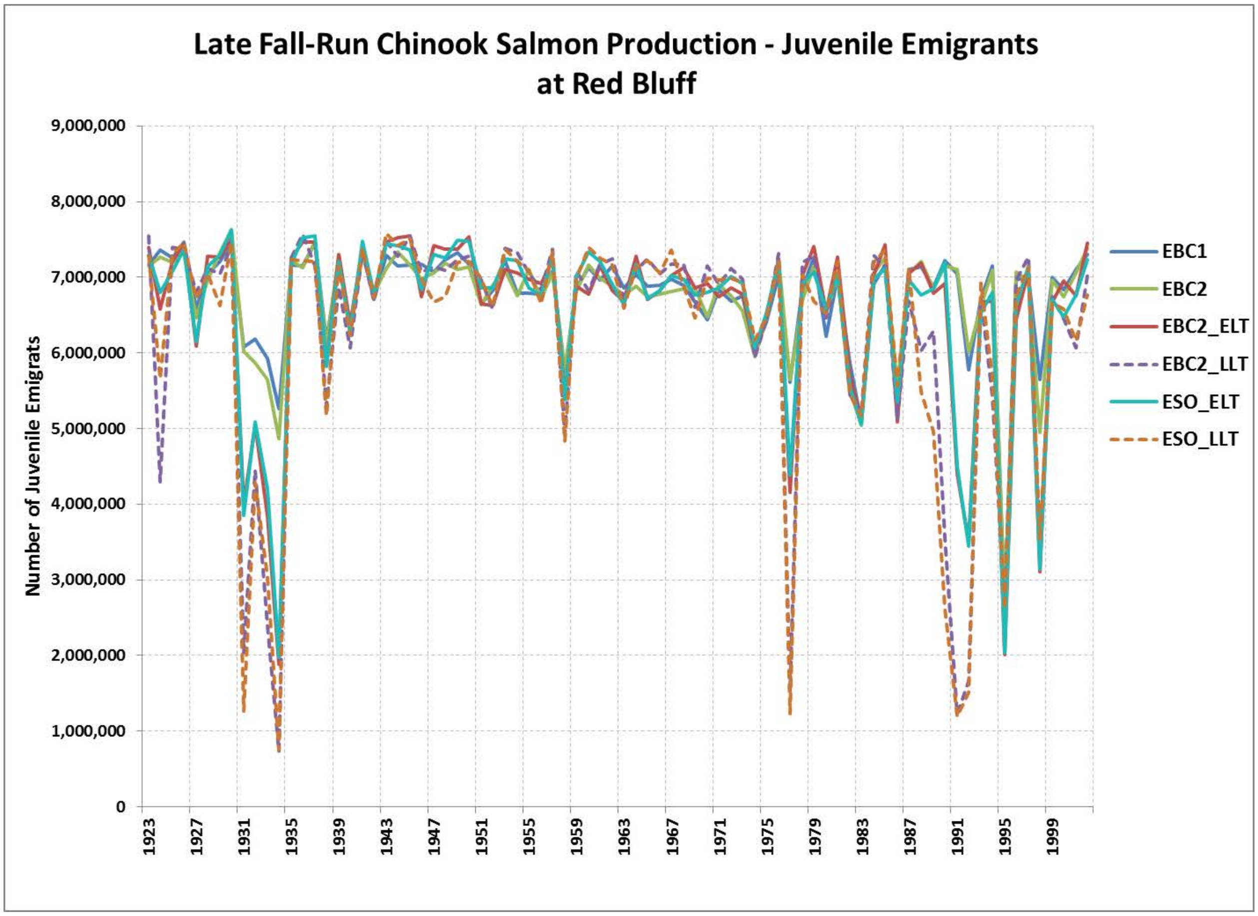
Table 5C.5.2-56. Fall-Run Chinook Salmon Juvenile Production Estimates for EBC and ESO Scenarios

Estimate	Scenario[a]					
	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Minimum	3,571,943	3,302,935	3,043,494	2,946,519	3,033,523	2,888,255
Maximum	35,672,747	36,030,289	36,221,030	36,642,812	36,297,277	36,768,376
Average	27,969,085	28,189,420	26,163,320	24,527,156	26,098,552	23,975,307
Change (Percent) from Average EBC2_ELT					-64,769 (-0.2%)	
Change (Percent) from Average EBC2_LLT						-551,849 (-2.2%)

Source: SALMOD.
[a] See Table 5C.0-1 for definitions of the scenarios.

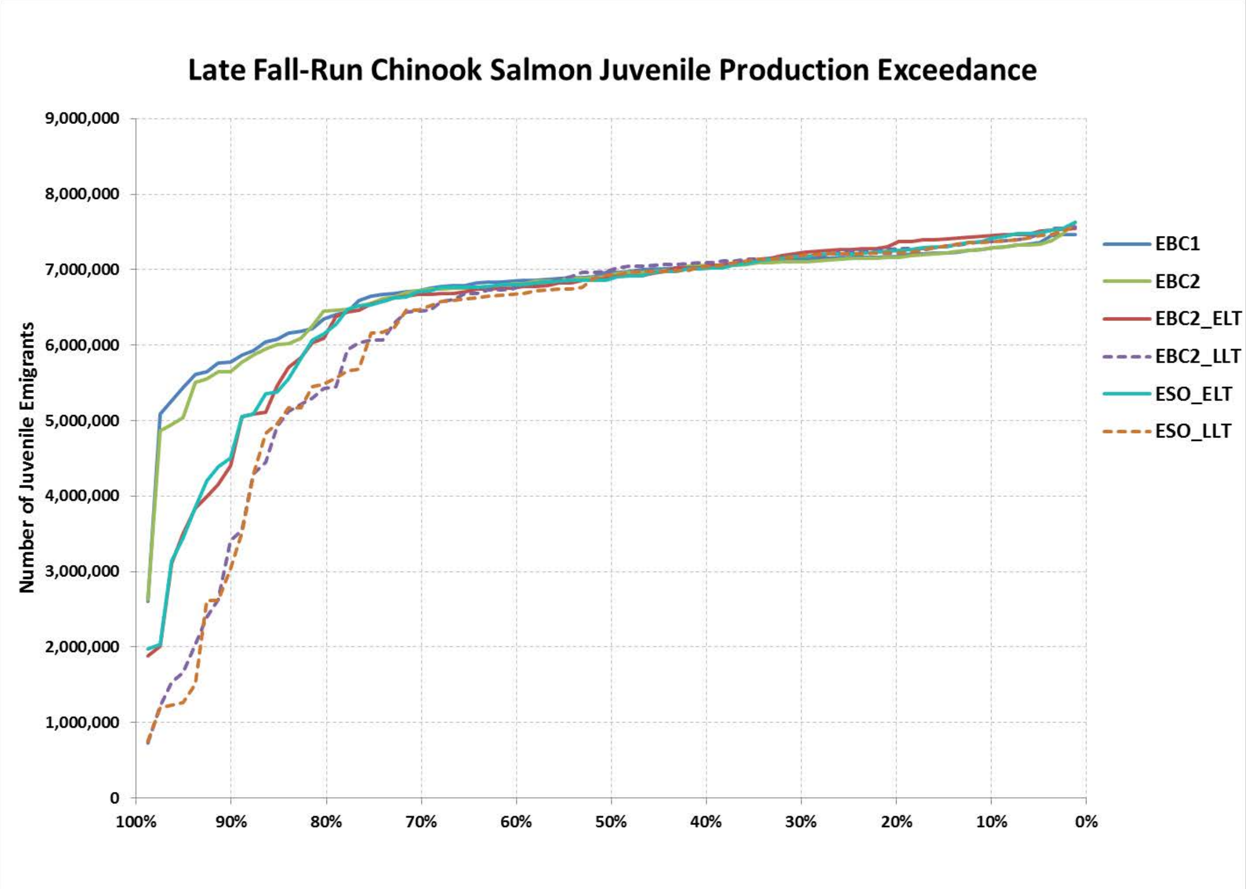
Because minimum juvenile production estimates for all model scenarios were all greater than the 100,000 individual threshold used to distinguish worst case scenarios for other races of Chinook salmon, the analysis was unneccesary for fall-run Chioook salmon.

SALMOD was used to predict late fall–run juvenile production using an adult escapement of 12,051 salmon (based on 1999–2006 escapement data from GrandTab 2008). Late fall–run production results are presented in Figure 5C.5.2-48 and. Figure 5C.5.2-49. SALMOD predicts that production under EBC1 and EBC2 would be similar and both would be greater than production under EBC2_ELT and ESO_ELT. Production under EBC2_ELT and ESO_ELT is predicted to be similar and both would be greater than production under EBC2_LLT and ESO_LLT. Production under EBC2_LLT and ESO_LLT is predicted to be similar. These results suggest that there is a moderate negative effect of future climate change on juvenile late fall–run production but no effects due to the ESO.



Note: All life stages are combined and converted to smolt equivalents.

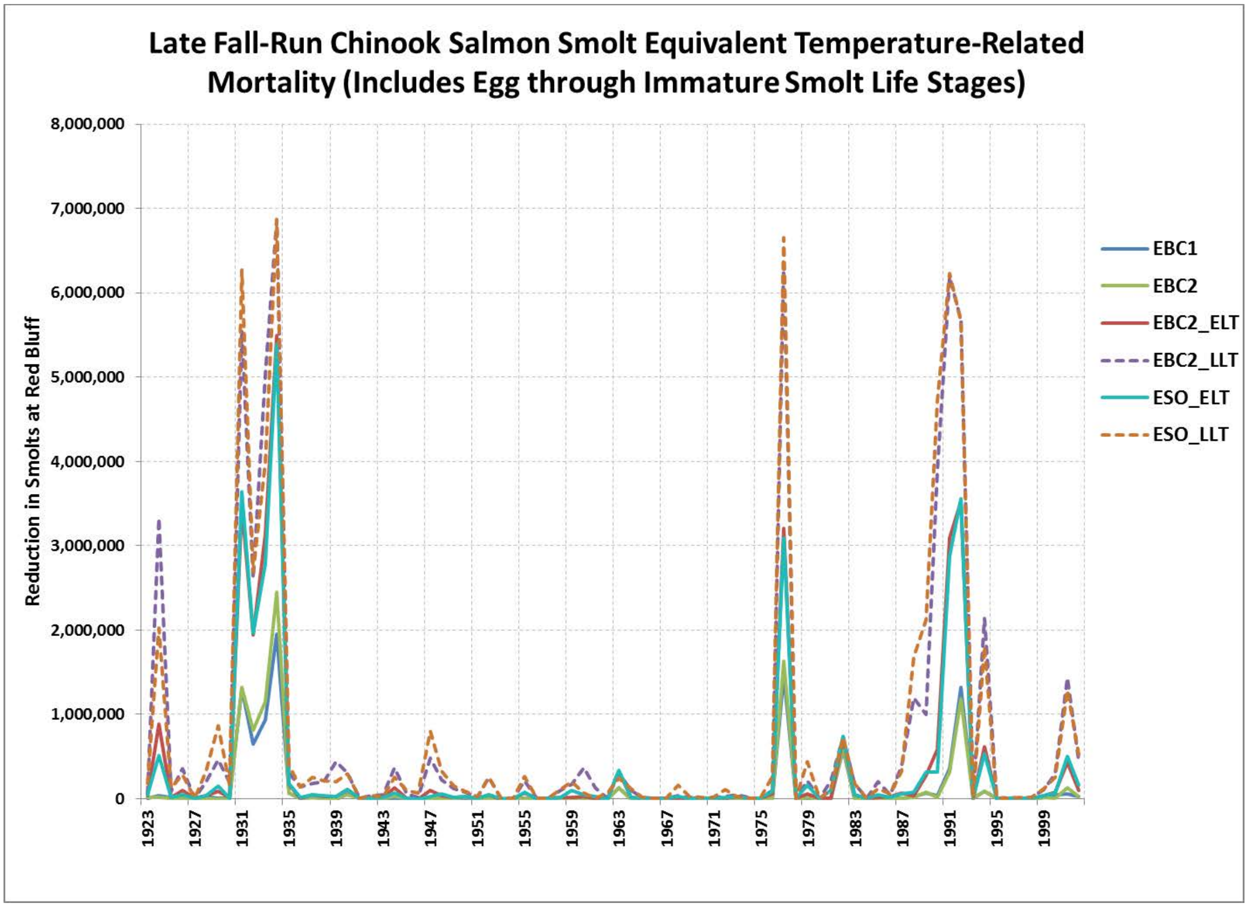
Figure 5C.5.2-48. Late Fall–Run Chinook Salmon Production at Red Bluff Diversion Dam under EBC and ESO Scenarios (SALMOD Model)



Note: All life stages are combined and converted to smolt equivalents.

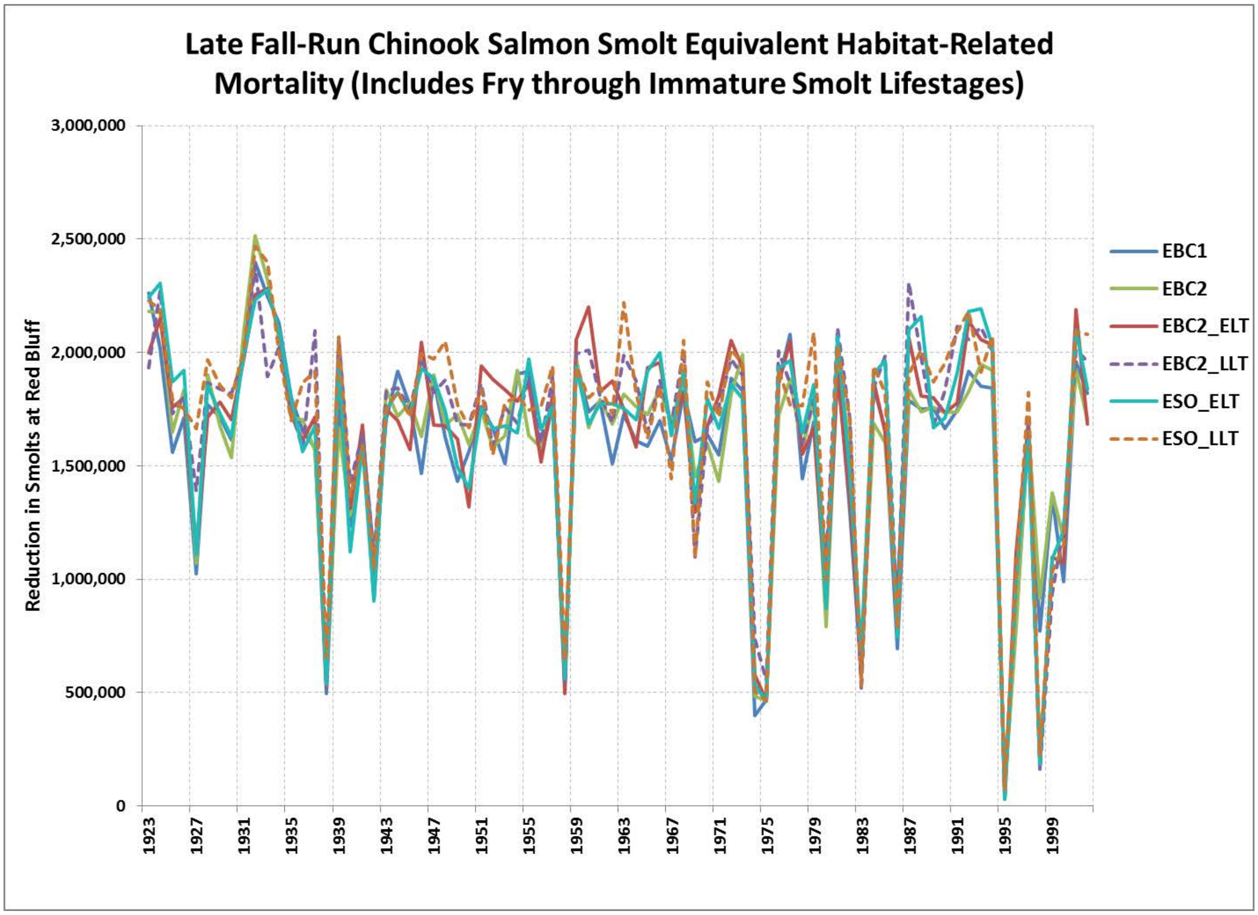
Figure 5C.5.2-49. Late Fall–Run Chinook Salmon Production Exceedance at Red Bluff Diversion Dam under EBC and ESO Scenarios (SALMOD Model)

Late fall–run Chinook spawn during the winter when water temperatures are generally suitable for egg incubation. Juvenile rearing occurs during the spring as temperatures warm. Smolt-equivalent temperature-related and habitat-related mortality through time from SALMOD is shown in Figure 5C.5.2-50 and Figure 5C.5.2-51, respectively. Figure 5C.5.2-52 and Figure 5C.5.2-53 display exceedance plots of temperature-related and habitat-related mortality, respectively. Temperature-related mortality is predicted to be lowest under EBC1 and EBC2 and highest under EBC2_LLT and ESO_LLT. There are no effects of the ESO predicted in either the ELT or LLT implementation periods. These results indicate that temperature-related mortality increases are a result of future climate change and not the ESO. Habitat-related mortality is predicted to be large in most years but differs very little among model scenarios. This is likely due to the relatively flat WUA versus flow curves for Chinook salmon (Gard 2005). Temperature-related mortality is predicted to overshadow habitat-related mortality in the years of high temperature-related mortality, when reservoir storage is likely to be low.



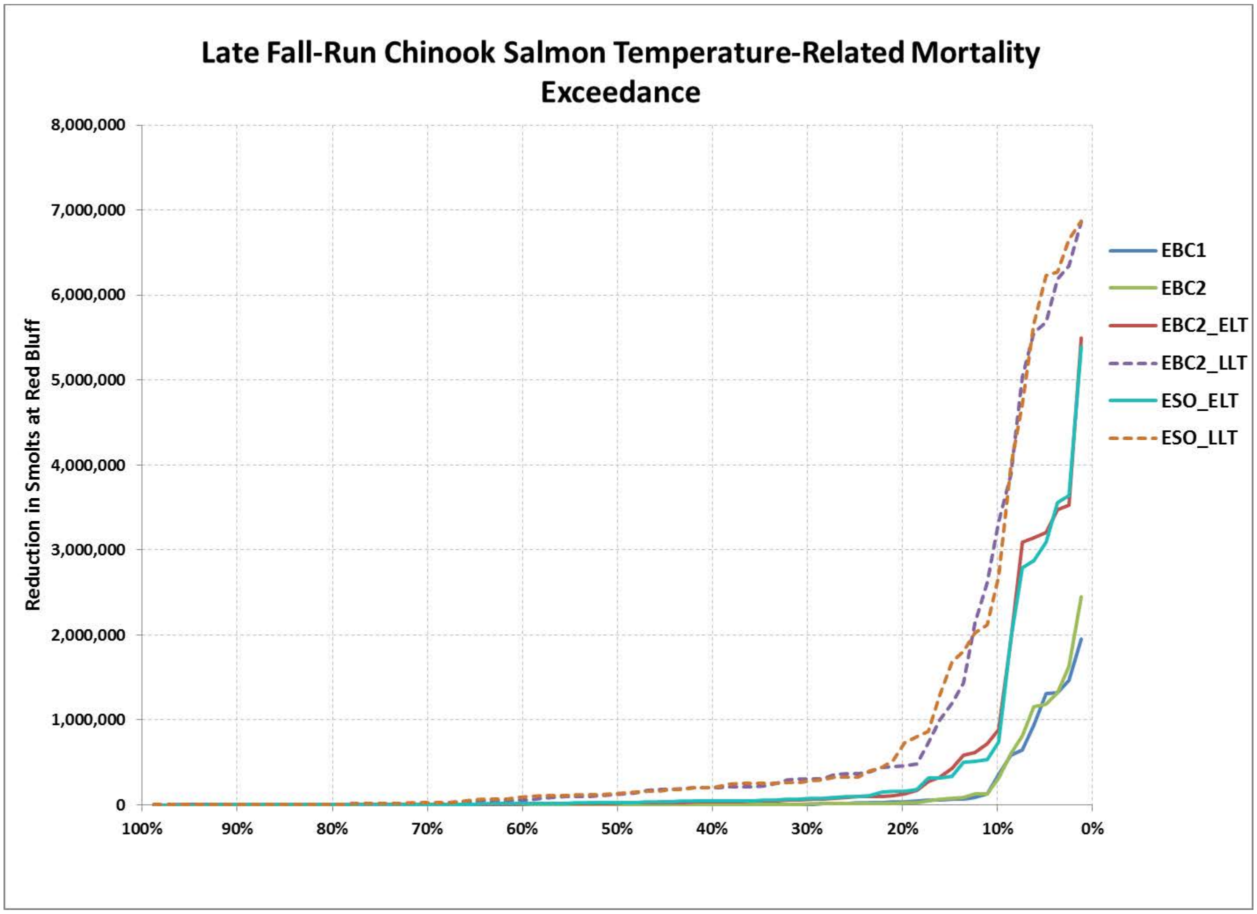
Note: All life stages are combined and converted to smolt equivalents.

Figure 5C.5.2-50. Late Fall–Run Chinook Salmon Temperature-Related Mortality (Egg through Smolt) under EBC and ESO Scenarios (SALMOD Model)



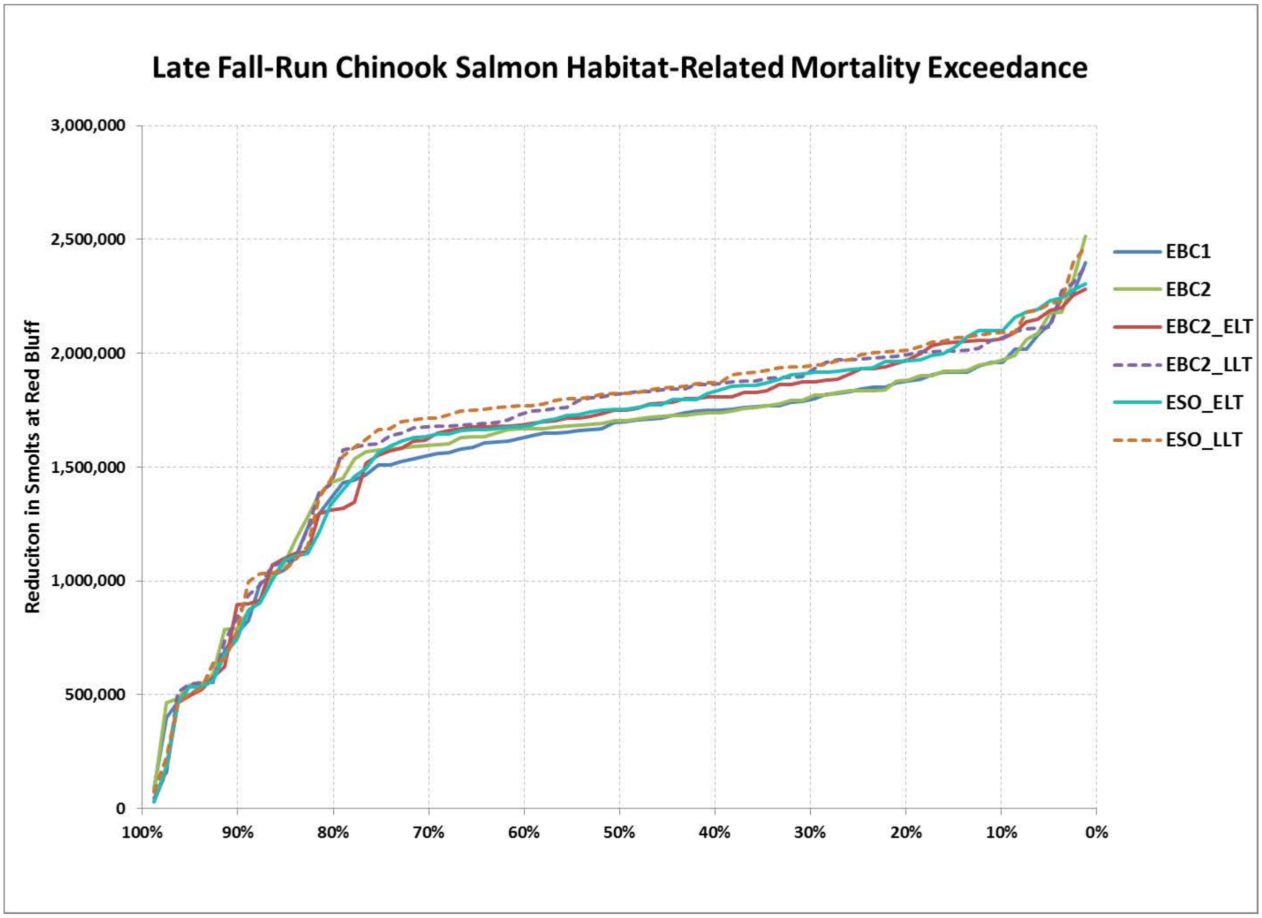
Note: All life stages are combined and converted to smolt equivalents.

Figure 5C.5.2-51. Late Fall–Run Chinook Salmon Habitat-Related Mortality (Fry through Smolt) under EBC and ESO Scenarios (SALMOD Model)



Note: All life stages are combined and converted to smolt equivalents.

Figure 5C.5.2-52. Late Fall–Run Chinook Salmon Temperature-Related Mortality (Egg through Smolt) Exceedance under EBC and ESO Scenarios (SALMOD Model)



Note: All life stages are combined and converted to smolt equivalents.

Figure 5C.5.2-53. Late Fall–Run Chinook Salmon Habitat-Related Mortality (Fry through Smolt) Exceedance under EBC and ESO Scenarios (SALMOD Model)

SALMOD-generated estimates of juvenile late fall–run Chinook salmon production are summarized in Table 5C.5.2-57. These results reflect changes in habitat value and quantity based on habitat estimates each year over the 82-year CALSIM period and assume an adult escapement each year of 12,051 adult late fall–run Chinook salmon. The predicted production of juvenile late fall–run Chinook salmon varies substantially among years (comparison of predicted minimum and maximum for each model scenario). Minimum production would be adversely affected by future climate change, although maximum production would not. Climate change would have a small effect on average production. The ESO would have a small to negligible effect on production. These results indicate that the ESO would not affect juvenile late fall–run production. Although SacEFT predicts a negative effect of flows under ESO on juvenile rearing and stranding, SALMOD did not find a habitat-related effect on overall juvenile production. These differences are likely driven by the use different algorithms for calculating accumulated thermal units (ATUs) that drive maturation rate and, therefore, timing of species presence, and possibly by the difference in time step (SacEFT is daily, SALMOD is weekly) (Attachment 5C.B, *Sacramento River Ecological Flows Tool (SacEFT): Record of Design (v.2.00)*). Further, juvenile production estimates from SALMOD integrate multiple factors affecting egg deposition, egg incubation, fry survival, and juvenile migration whereas SacEFT performance measures are individual factors that drive egg and fry survival.

Table 5C.5.2-57. Late Fall–Run Chinook Salmon Juvenile Production Estimates for EBC and ESO Scenarios

Estimate	Scenario[a]					
	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Minimum	2,604,736	2,622,313	1,880,415	733,222	1,980,670	753,672
Maximum	7,468,195	7,623,926	7,542,655	7,564,161	7,630,017	7,576,306
Average	6,742,345	6,705,834	6,524,799	6,256,552	6,523,374	6,211,071
Change (Percent) from Average EBC2_ELT					-1,425 (-0.02	
Change (Percent) from Average EBC2_LLT						-45,481 (-0.7%)

Source: SALMOD
[a] See Table 5C.0-1 for definitions of the scenarios.

Because minimum juvenile production estimates for all model scenarios were all greater than the 100,000 individual threshold used to distinguish worst case scenarios for other races of Chinook salmon, the analysis was unneccesary for late fall–run Chioook salmon.

5C.5.2.1.4.3 Adult

Water Temperature

Sacramento River water temperatures during the fall-run (July–December) and late fall–run (November–April) adult migration periods have been historically cool (i.e., <65°F). Conditions for adult migration are generally expected to be suitable under all EBC1, EBC2, and ESO scenarios. Predicted average water temperatures by month and water-year type for the Sacramento River at Keswick and Bend Bridge, representative adult holding sites in the upper Sacramento River, are presented in Table 5C.5.2-15 and Table 5C.5.2-16, respectively and differences between model scenarios are presented in Table 5C.5.2-17 and Table 5C.5.2-18, respectively. These results indicate that there would be very small (<2%) differences in water temperature in the Sacramento River at Keswick or Bend Bridge during July and December for fall-run and November through April for late fall–run regardless of water-year type between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. Further, water temperatures under HOS and LOS scenarios would be very similar to those under ESO (Table 5C.5.2-19, Table 5C.5.2-20, Table 5C.5.2-21, Table 5C.5.2-22). Given these results, it was concluded that there would be no water temperature-related effects of the ESO, HOS, or LOS on adult migration and holding conditions. Therefore, it was determined that no further temperature-related biological analyses are necessary.

5C.5.2.1.5 Splittail

Because most splittail are only upstream in the Sacramento River from February through June for spawning, egg incubation, and larval and juvenile rearing, and there is high overlap among all lifestages during this period, this analysis combines all lifestages together. Important distinctions among life stages are discussed where necessary.

Spawning and Rearing Habitat

Inundated floodplain habitat is the most important habitat for splittail spawning and rearing because splittail population dynamics are largely driven by floodplain spawning in wet years, when this habitat is most available. Effects of the ESO on this habitat are described below in Section 5C.5.4, *Delta Habitat (Plan Area) Results*. Splittail spawning and larval and juvenile rearing also occur in channel margin and side-channel habitat upstream of the Delta. These habitats are likely to be especially important during dry years, when flows are too low to inundate the floodplains (Sommer et al. 2007). In recent years, splittail have been found upstream as far as the RBDD in the Sacramento River. Backwater location was the only habitat factor that rearing splittail were found to select in upstream locations (Feyrer et al. 2005). An unknown, but likely relatively small, fraction of Sacramento River juveniles migrate upstream to rear through the summer, fall and winter in off-channel habitats in the upper Sacramento River. These fish migrate to the Delta and Suisun Marsh the following spring (Moyle et al. 2004; Feyrer et al. 2005).

Side-channel habitats are affected by changes in flow because greater flows cause more side channel inundation, thereby increasing availability of such habitat, and because rapid reductions in flow dewater the habitats, potentially stranding splittail eggs and rearing larvae. Effects of the BDCP on upstream flows in years with low-flows are expected to be most important to the splittail population because in years of high-flows, when most production comes from floodplain habitats, the upstream side-channel habitats contribute relatively little production. Simulated flows in the Sacramento River at Wilkins Slough were used to investigate the potential effects of BDCP operations on side channel habitat availability on the mainstem Sacramento River. This analysis was limited to flows during February through June because these are the most important months for splittail spawning and larval and juvenile rearing and the months in which splittail are most likely to be upstream in the Sacramento River.

Monthly average flows in the Sacramento River at Wilkins Slough are presented by water-year type in Table 5C.5.2-58 and differences between pairs of model scenarios are presented in Table 5C.5.2-59. Monthly exceedance plots are presented in Figure 5C.5.2-54 through Figure 5C.5.2-65. Exceedance plots for the upstream splittail spawning period (February through June) are presented in Figure 5C.5.2-55 through Figure 5C.5.2-59. Results show that flows under the ESO_ELT and ESO_LLT during this period would generally be greater than or similar to flows under EBC2_ELT and EBC2_LLT, respectively. Benefits of the ESO would generally be higher in intermediate water years (above normal, below normal, and dry), particularly in above normal water years (up to 15% higher in ESO relative to EBC2). These results indicate that side channel habitat available for splittail spawning and rearing in the Sacramento River under the ESO would be similar to or increase under the ESO depending on month and water-year type. Habitat in drier water years (below normal, dry, and critical) would increase under the ESO in some months, thus providing spawning and rearing habitat splittail when it is needed most. There would be occasional differences in flows between the ESO scenario and HOS and LOS scenarios (Table 5C.5.2-60, Table 5C.5.2-61, although none would cause biologically meaningful effects on splittail population.

Table 5C.5.2-58. Mean Monthly Flows (cfs) in the Sacramento River at Wilkins Slough under EBC and ESO Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	19,145	19,105	19,250	19,320	19,275	19,359
	AN	17,084	16,512	16,521	16,593	16,611	16,553
	BN	12,521	12,400	12,322	12,143	12,640	12,270
	D	8,896	8,849	8,896	9,189	8,825	8,906
	C	7,858	8,081	8,152	8,586	7,860	8,744
	All	13,811	13,716	13,771	13,901	13,788	13,890
Feb	W	19,887	19,831	19,976	20,044	19,992	20,053
	AN	19,139	19,071	19,134	19,095	19,219	19,120
	BN	14,528	14,370	14,508	14,328	14,557	14,445
	D	11,520	11,580	11,451	11,473	11,451	11,471
	C	8,499	8,495	8,220	8,158	8,354	8,135
	All	15,359	15,317	15,327	15,309	15,373	15,331
Mar	W	18,223	18,261	18,325	18,323	18,323	18,324
	AN	17,696	17,632	17,638	17,537	17,712	17,686
	BN	12,208	12,011	11,505	11,534	11,673	11,462
	D	11,364	11,392	11,289	11,191	11,264	11,337
	C	8,101	8,272	8,201	8,166	8,386	8,426
	All	14,132	14,132	14,034	13,997	14,095	14,077
Apr	W	13,392	13,400	13,312	13,119	13,315	13,032
	AN	10,264	10,199	10,038	9,783	10,063	10,072
	BN	7,152	7,022	6,795	6,858	6,847	7,262
	D	5,319	5,201	5,082	5,112	5,217	5,342
	C	4,164	4,127	4,136	4,331	4,097	4,264
	All	8,746	8,686	8,571	8,518	8,608	8,642
May	W	10,467	10,345	9,445	8,435	9,447	8,826
	AN	7,318	7,244	6,978	7,500	7,820	8,652
	BN	5,638	5,423	4,981	4,871	5,315	5,712
	D	4,669	4,507	4,454	5,088	4,817	5,974
	C	3,998	3,936	4,155	4,528	4,177	4,728
	All	6,962	6,832	6,452	6,383	6,716	7,043
Jun	W	6,503	6,421	6,226	6,435	6,467	7,353
	AN	5,781	5,873	5,958	6,530	6,523	8,036
	BN	5,243	5,257	5,205	5,628	5,811	6,330
	D	5,245	5,297	5,586	6,075	6,212	6,758
	C	5,140	5,343	5,753	6,253	5,957	6,129
	All	5,707	5,738	5,803	6,205	6,233	6,968
Jul	W	6,685	6,592	7,162	7,771	7,367	7,838
	AN	6,971	7,039	7,307	7,892	7,304	7,667
	BN	6,122	6,147	6,503	6,560	6,873	6,378
	D	6,788	6,947	7,240	7,474	7,172	6,435
	C	7,162	6,872	6,577	6,649	6,708	6,366
	All	6,723	6,700	7,002	7,353	7,134	7,041

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Aug	W	6,287	6,030	5,492	5,537	5,548	5,482
	AN	5,498	5,578	5,765	6,610	6,063	6,280
	BN	5,138	5,156	4,984	5,462	5,755	5,350
	D	5,833	5,952	5,723	6,356	4,574	4,799
	C	5,551	5,569	4,963	4,719	4,578	4,524
	All	5,768	5,730	5,419	5,741	5,303	5,286
Sep	W	9,338	12,208	11,904	12,737	11,624	13,105
	AN	5,631	7,841	8,877	9,546	7,485	8,995
	BN	5,128	5,054	5,291	5,216	4,733	4,453
	D	5,636	5,281	4,629	4,114	4,269	4,783
	C	5,200	4,904	4,689	4,354	4,514	5,303
	All	6,658	7,758	7,679	7,866	7,187	8,058
Oct	W	7,347	6,909	6,876	7,382	6,840	7,240
	AN	6,799	5,904	5,809	6,927	5,523	6,943
	BN	5,987	5,847	5,344	6,570	5,196	5,935
	D	5,688	5,382	5,411	6,040	5,386	5,809
	C	5,642	5,314	5,205	5,572	4,902	5,531
	All	6,421	6,012	5,892	6,617	5,764	6,409
Nov	W	9,644	10,899	10,843	10,889	9,684	9,709
	AN	8,210	9,033	9,465	9,141	7,845	7,467
	BN	6,793	7,538	7,688	7,588	6,308	6,539
	D	7,407	7,310	7,354	7,227	6,528	6,394
	C	5,118	5,185	5,081	4,986	4,722	4,679
	All	7,794	8,428	8,494	8,402	7,419	7,376
Dec	W	17,881	17,447	17,819	17,257	17,877	17,141
	AN	10,809	10,876	10,921	10,755	10,833	10,981
	BN	8,505	8,283	8,283	8,258	8,306	8,458
	D	8,950	8,707	8,665	8,725	8,633	8,813
	C	6,229	5,947	5,989	5,981	6,122	6,010
	All	11,580	11,319	11,441	11,246	11,463	11,300

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-59. Differences[a] between EBC and ESO Scenarios in Mean Monthly Flows in the Sacramento River at Wilkins Slough

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	-39 (-0.2%)	253 (1.3%)	170 (0.9%)	253 (1.3%)	25 (0.1%)	38 (0.2%)
	AN	-572 (-3.3%)	-261 (-1.5%)	100 (0.6%)	41 (0.3%)	90 (0.5%)	-41 (-0.2%)
	BN	-122 (-1%)	281 (2.2%)	241 (1.9%)	-129 (-1%)	318 (2.6%)	127 (1%)
	D	-47 (-0.5%)	60 (0.7%)	-24 (-0.3%)	57 (0.6%)	-71 (-0.79%)	-282 (-3.1%)
	C	224 (2.8%)	1358 (17.3%)	-221 (-2.7%)	663 (8.2%)	-292 (-3.6%)	158 (1.8%)
	All	-94 (-0.7%)	302 (2.2%)	72 (0.5%)	174 (1.3%)	17 (0.1%)	-11 (-0.1%)
Feb	W	-57 (-0.3%)	196 (1%)	161 (0.8%)	222 (1.1%)	16 (0.1%)	9 (0%)
	AN	-68 (-0.4%)	404 (2.1%)	149 (0.8%)	49 (0.3%)	85 (0.4%)	24 (0.1%)
	BN	-158 (-1.1%)	398 (2.7%)	187 (1.3%)	75 (0.5%)	49 (0.3%)	117 (0.8%)
	D	60 (0.5%)	-84 (-0.7%)	-129 (-1.1%)	-109 (-0.9%)	0 (0%)	-2 (0%)
	C	-4 (0%)	-365 (-4.3%)	-141 (-1.7%)	-360 (-4.2%)	134 (1.6%)	-24 (-0.3%)
	All	-42 (-0.3%)	117 (0.8%)	56 (0.4%)	14 (0.1%)	46 (0.3%)	22 (0.1%)
Mar	W	38 (0.2%)	112 (0.6%)	63 (0.3%)	63 (0.3%)	-1 (-0.01%)	1 (0%)
	AN	-64 (-0.4%)	100 (0.6%)	80 (0.5%)	54 (0.3%)	75 (0.4%)	149 (0.9%)
	BN	-196 (-1.6%)	-202 (-1.7%)	-339 (-2.8%)	-549 (-4.6%)	168 (1.5%)	-72 (-0.6%)
	D	28 (0.2%)	-186 (-1.6%)	-128 (-1.1%)	-55 (-0.5%)	-25 (-0.2%)	146 (1.3%)
	C	171 (2.1%)	136 (1.7%)	114 (1.4%)	154 (1.9%)	185 (2.3%)	260 (3.2%)
	All	1 (0%)	-5 (0%)	-38 (-0.3%)	-55 (-0.4%)	61 (0.4%)	80 (0.6%)
Apr	W	8 (0.1%)	-267 (-2%)	-85 (-0.6%)	-368 (-2.7%)	3 (0%)	-87 (-0.7%)
	AN	-65 (-0.6%)	-189 (-1.8%)	-135 (-1.3%)	-127 (-1.2%)	25 (0.3%)	290 (3%)
	BN	-131 (-1.8%)	-186 (-2.6%)	-174 (-2.5%)	240 (3.4%)	52 (0.8%)	404 (5.9%)
	D	-118 (-2.2%)	34 (0.6%)	15 (0.3%)	141 (2.7%)	134 (2.6%)	229 (4.5%)
	C	-37 (-0.9%)	100 (2.4%)	-30 (-0.7%)	137 (3.3%)	-39 (-1%)	-67 (-1.5%)
	All	-61 (-0.7%)	-122 (-1.4%)	-77 (-0.9%)	-43 (-0.5%)	37 (0.4%)	124 (1.5%)
May	W	-122 (-1.2%)	-2027 (-19.4%)	-898 (-8.7%)	-1519 (-14.7%)	3 (0%)	391 (4.6%)
	AN	-74 (-1%)	275 (3.8%)	575 (7.9%)	1407 (19.4%)	841 (12.1%)	1152 (15.4%)
	BN	-214 (-3.8%)	-716 (-12.7%)	-109 (-2%)	289 (5.3%)	334 (6.7%)	841 (17.3%)
	D	-162 (-3.5%)	400 (8.6%)	309 (6.9%)	1467 (32.5%)	363 (8.2%)	887 (17.4%)
	C	-62 (-1.5%)	523 (13.1%)	240 (6.1%)	792 (20.1%)	22 (0.5%)	200 (4.4%)
	All	-130 (-1.9%)	-560 (-8%)	-116 (-1.7%)	211 (3.1%)	264 (4.1%)	660 (10.3%)
Jun	W	-82 (-1.3%)	-90 (-1.4%)	46 (0.7%)	932 (14.5%)	241 (3.9%)	917 (14.3%)
	AN	92 (1.6%)	619 (10.7%)	649 (11.1%)	2163 (36.8%)	565 (9.5%)	1506 (23.1%)
	BN	14 (0.3%)	583 (11.1%)	554 (10.5%)	1073 (20.4%)	606 (11.6%)	702 (12.5%)
	D	52 (1%)	1008 (19.2%)	915 (17.3%)	1461 (27.6%)	626 (11.2%)	683 (11.3%)
	C	203 (3.9%)	1065 (20.7%)	614 (11.5%)	786 (14.7%)	205 (3.6%)	-124 (-2%)
	All	31 (0.5%)	539 (9.4%)	495 (8.6%)	1231 (21.5%)	430 (7.4%)	763 (12.3%)
Jul	W	-92 (-1.4%)	1102 (16.5%)	774 (11.7%)	1246 (18.9%)	204 (2.9%)	67 (0.9%)
	AN	68 (1%)	903 (13%)	265 (3.8%)	628 (8.9%)	-3 (0%)	-225 (-2.8%)
	BN	25 (0.4%)	584 (9.5%)	727 (11.8%)	232 (3.8%)	370 (5.7%)	-182 (-2.8%)
	D	159 (2.3%)	751 (11.1%)	226 (3.2%)	-511 (-7.4%)	-68 (-0.9%)	-1039 (-13.9%)
	C	-290 (-4%)	-162 (-2.3%)	-164 (-2.4%)	-506 (-7.4%)	131 (2%)	-283 (-4.3%)
	All	-23 (-0.3%)	722 (10.7%)	434 (6.5%)	340 (5.1%)	132 (1.9%)	-312 (-4.2%)

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Aug	W	-257 (-4.1%)	-757 (-12%)	-481 (-8%)	-548 (-9.1%)	56 (1%)	-54 (-1%)
	AN	80 (1.4%)	1129 (20.5%)	486 (8.7%)	703 (12.6%)	299 (5.2%)	-330 (-5%)
	BN	18 (0.4%)	620 (12.1%)	599 (11.6%)	195 (3.8%)	770 (15.5%)	-112 (-2%)
	D	119 (2%)	691 (11.9%)	-1379 (-23.2%)	-1153 (-19.4%)	-1149 (-20.1%)	-1557 (-24.5%)
	C	18 (0.3%)	-1043 (-18.8%)	-991 (-17.8%)	-1045 (-18.8%)	-385 (-7.8%)	-195 (-4.1%)
	All	-38 (-0.7%)	30 (0.5%)	-427 (-7.5%)	-444 (-7.7%)	-115 (-2.1%)	-455 (-7.9%)
Sep	W	2870 (30.7%)	-2618 (-28%)	-584 (-4.8%)	897 (7.4%)	-279 (-2.3%)	368 (2.9%)
	AN	2210 (39.2%)	234 (4.2%)	-357 (-4.5%)	1154 (14.7%)	-1393 (-15.7%)	-551 (-5.8%)
	BN	-74 (-1.4%)	398 (7.8%)	-321 (-6.4%)	-601 (-11.9%)	-558 (-10.6%)	-763 (-14.6%)
	D	-355 (-6.3%)	-995 (-17.7%)	-1012 (-19.2%)	-498 (-9.4%)	-360 (-7.8%)	669 (16.3%)
	C	-296 (-5.7%)	-783 (-15.1%)	-391 (-8%)	398 (8.1%)	-175 (-3.7%)	949 (21.8%)
	All	1100 (16.5%)	-1061 (-15.9%)	-571 (-7.4%)	300 (3.9%)	-492 (-6.4%)	191 (2.4%)
Oct	W	-437 (-6%)	-359 (-4.9%)	-69 (-1%)	331 (4.8%)	-36 (-0.5%)	-142 (-1.9%)
	AN	-895 (-13.2%)	-866 (-12.7%)	-381 (-6.5%)	1039 (17.6%)	-286 (-4.9%)	16 (0.2%)
	BN	-140 (-2.3%)	68 (1.1%)	-651 (-11.1%)	88 (1.5%)	-148 (-2.8%)	-635 (-9.7%)
	D	-306 (-5.4%)	-94 (-1.6%)	5 (0.1%)	427 (7.9%)	-25 (-0.5%)	-231 (-3.8%)
	C	-328 (-5.8%)	44 (0.8%)	-412 (-7.7%)	217 (4.1%)	-303 (-5.8%)	-41 (-0.7%)
	All	-409 (-6.4%)	-243 (-3.8%)	-248 (-4.1%)	397 (6.6%)	-128 (-2.2%)	-208 (-3.1%)
Nov	W	1255 (13%)	-93 (-1%)	-1215 (-11.2%)	-1189 (-10.9%)	-1159 (-10.7%)	-1180 (-10.8%)
	AN	824 (10%)	430 (5.2%)	-1188 (-13.2%)	-1566 (-17.3%)	-1620 (-17.1%)	-1673 (-18.3%)
	BN	745 (11%)	-417 (-6.1%)	-1230 (-16.3%)	-999 (-13.3%)	-1380 (-17.9%)	-1049 (-13.8%)
	D	-98 (-1.3%)	-940 (-12.7%)	-782 (-10.7%)	-916 (-12.5%)	-826 (-11.2%)	-833 (-11.5%)
	C	67 (1.3%)	-494 (-9.6%)	-464 (-8.9%)	-506 (-9.8%)	-360 (-7.1%)	-306 (-6.1%)
	All	634 (8.1%)	-316 (-4.1%)	-1009 (-12%)	-1052 (-12.5%)	-1074 (-12.6%)	-1026 (-12.2%)
Dec	W	-435 (-2.4%)	29 (0.2%)	431 (2.5%)	-306 (-1.8%)	58 (0.3%)	-116 (-0.7%)
	AN	67 (0.6%)	-203 (-1.9%)	-43 (-0.4%)	105 (1%)	-88 (-0.8%)	227 (2.1%)
	BN	-222 (-2.6%)	-88 (-1%)	23 (0.3%)	174 (2.1%)	23 (0.3%)	199 (2.4%)
	D	-243 (-2.7%)	-185 (-2.1%)	-73 (-0.8%)	106 (1.2%)	-32 (-0.36%)	88 (1%)
	C	-282 (-4.5%)	-190 (-3.1%)	175 (2.9%)	63 (1.1%)	134 (2.2%)	29 (0.5%)
	All	-260 (-2.2%)	-104 (-0.9%)	144 (1.3%)	-19 (-0.2%)	22 (0.2%)	54 (0.5%)

[a] Positive values indicate a higher monthly flows in the ESO than in EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

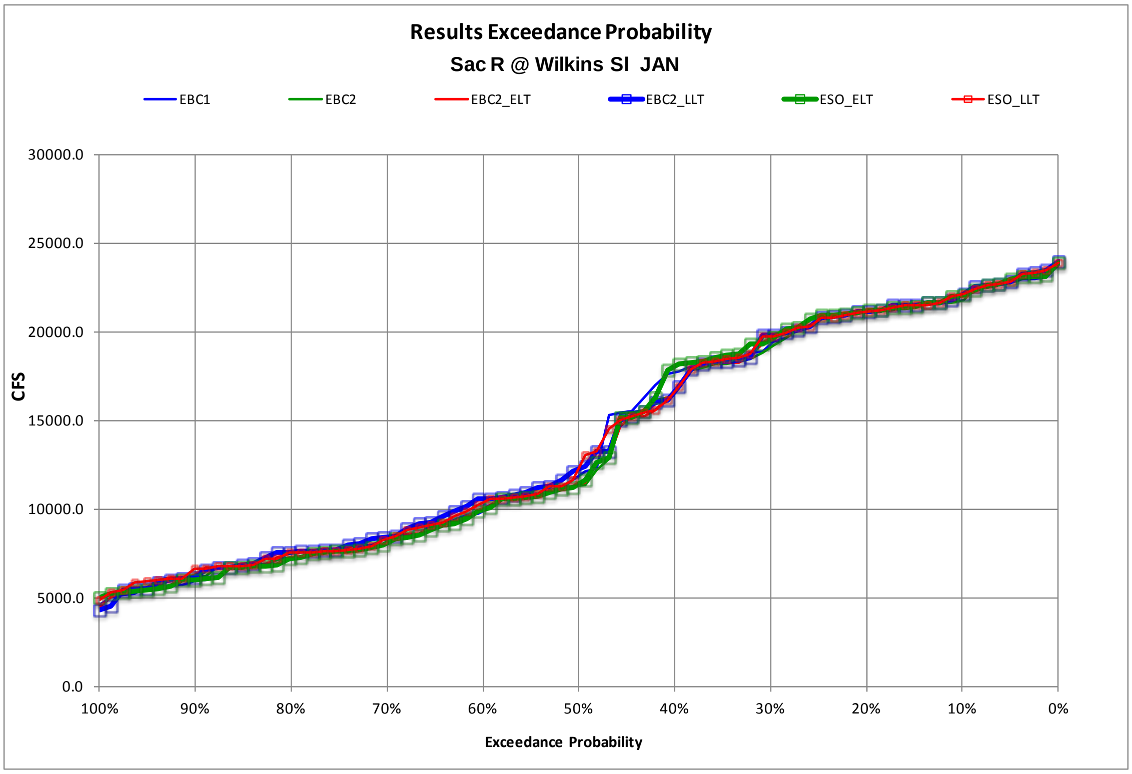


Figure 5C.5.2-54. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Wilkins Slough, January

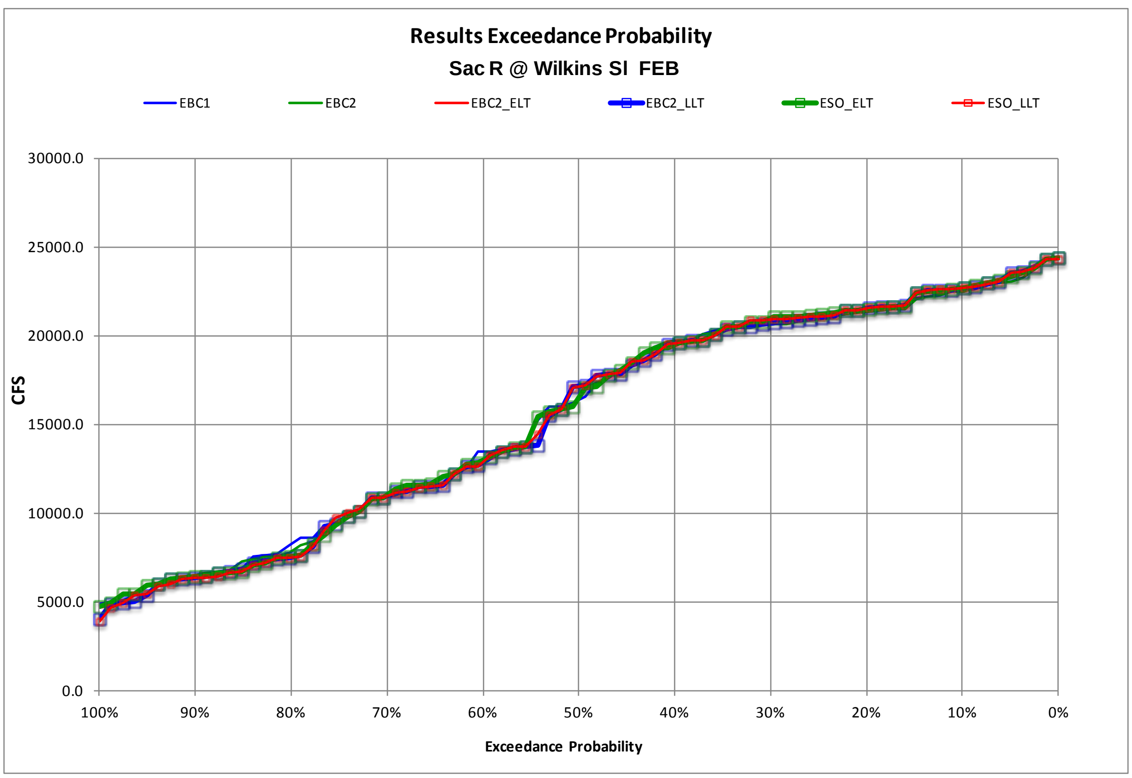


Figure 5C.5.2-55. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Wilkins Slough, February

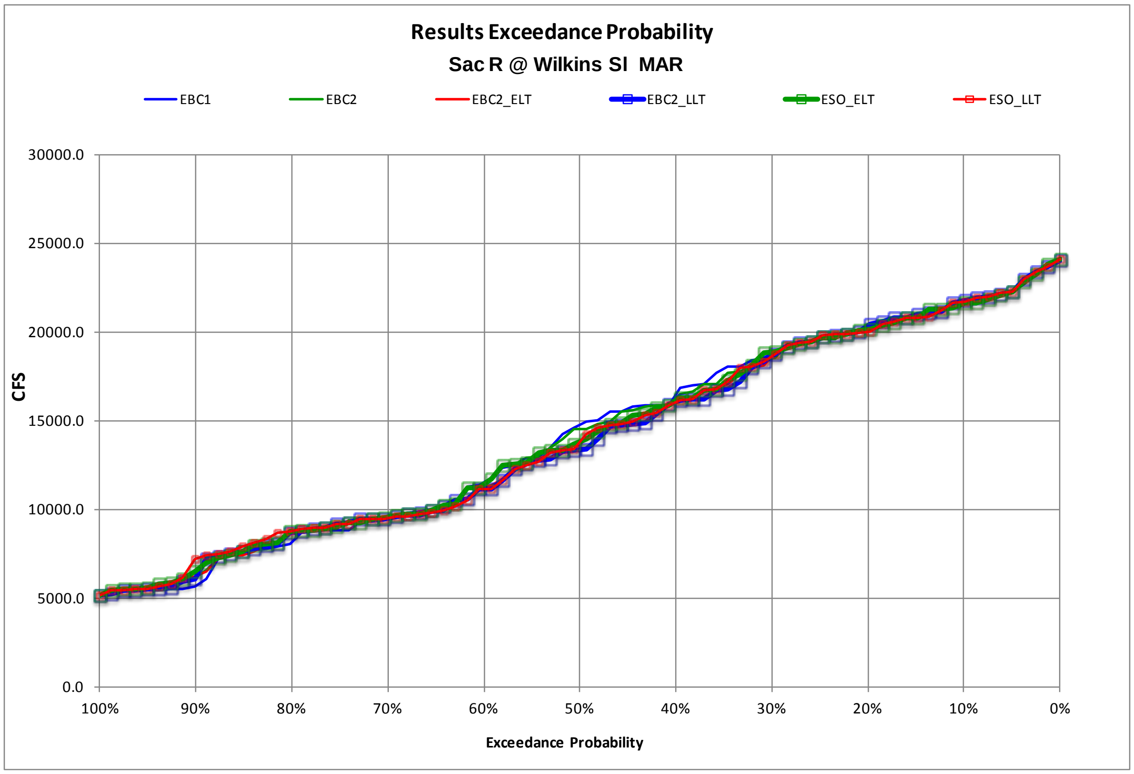


Figure 5C.5.2-56. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Wilkins Slough, March

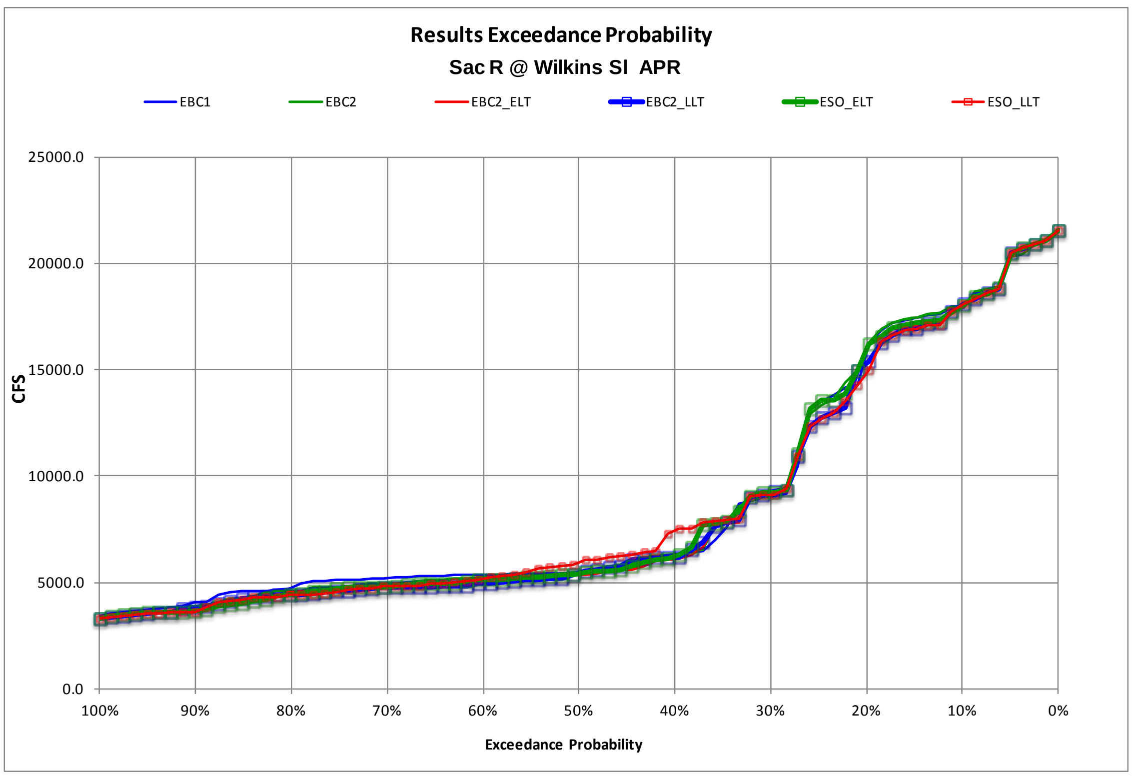


Figure 5C.5.2-57. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Wilkins Slough, April

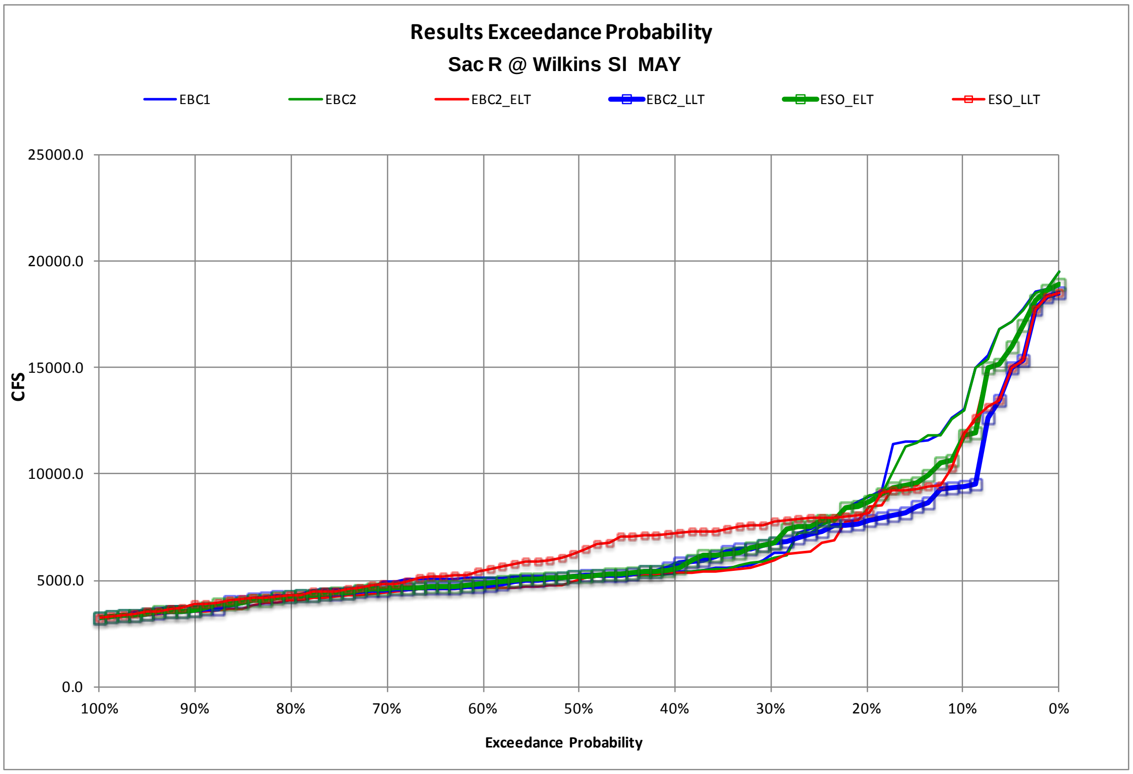


Figure 5C.5.2-58. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Wilkins Slough, May

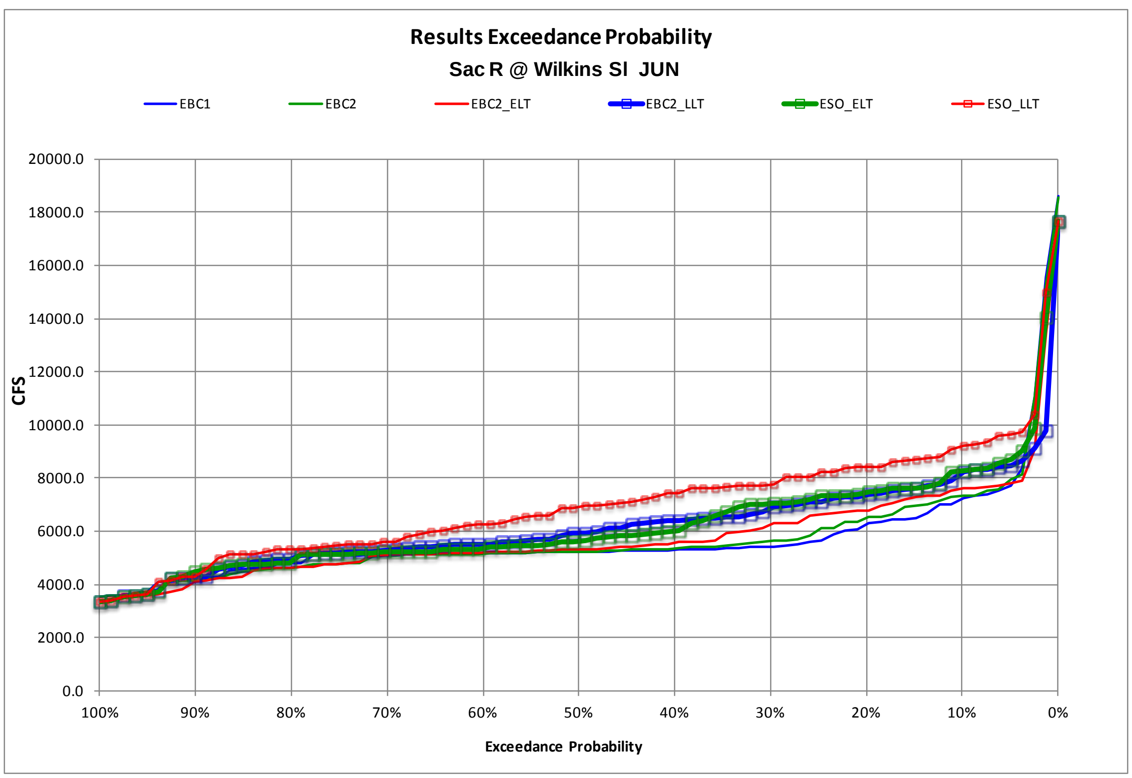


Figure 5C.5.2-59. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Wilkins Slough, June

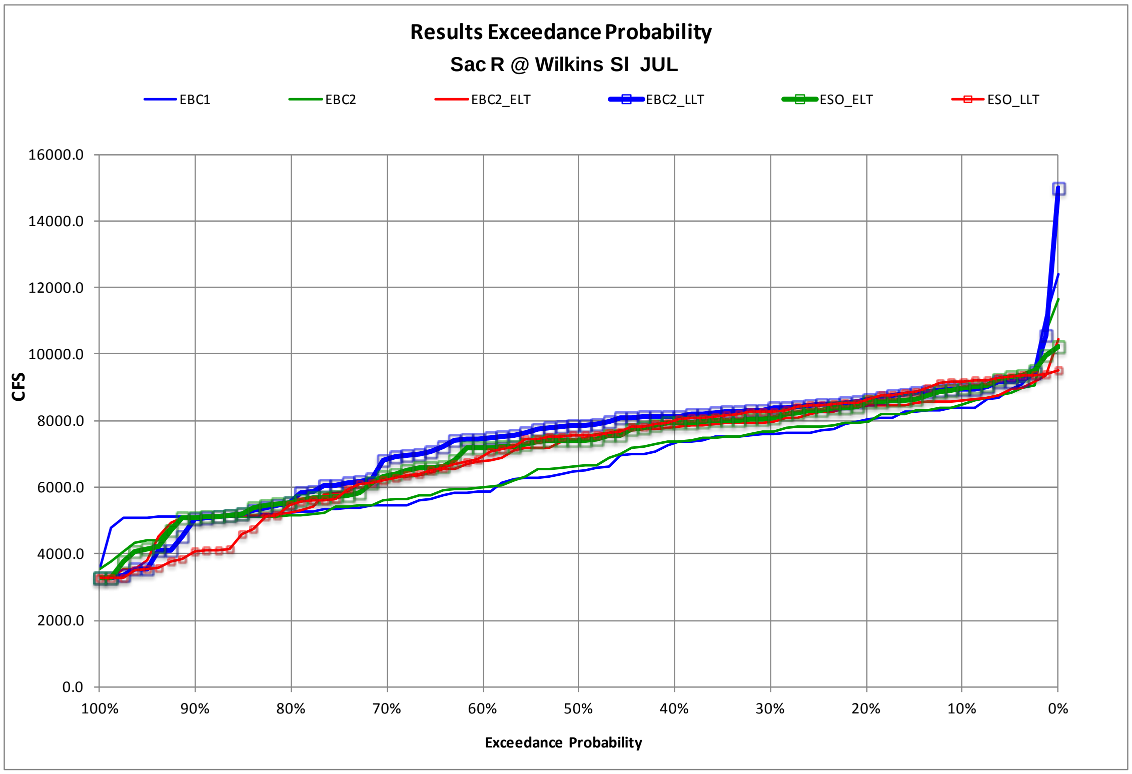


Figure 5C.5.2-60. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Wilkins Slough, July

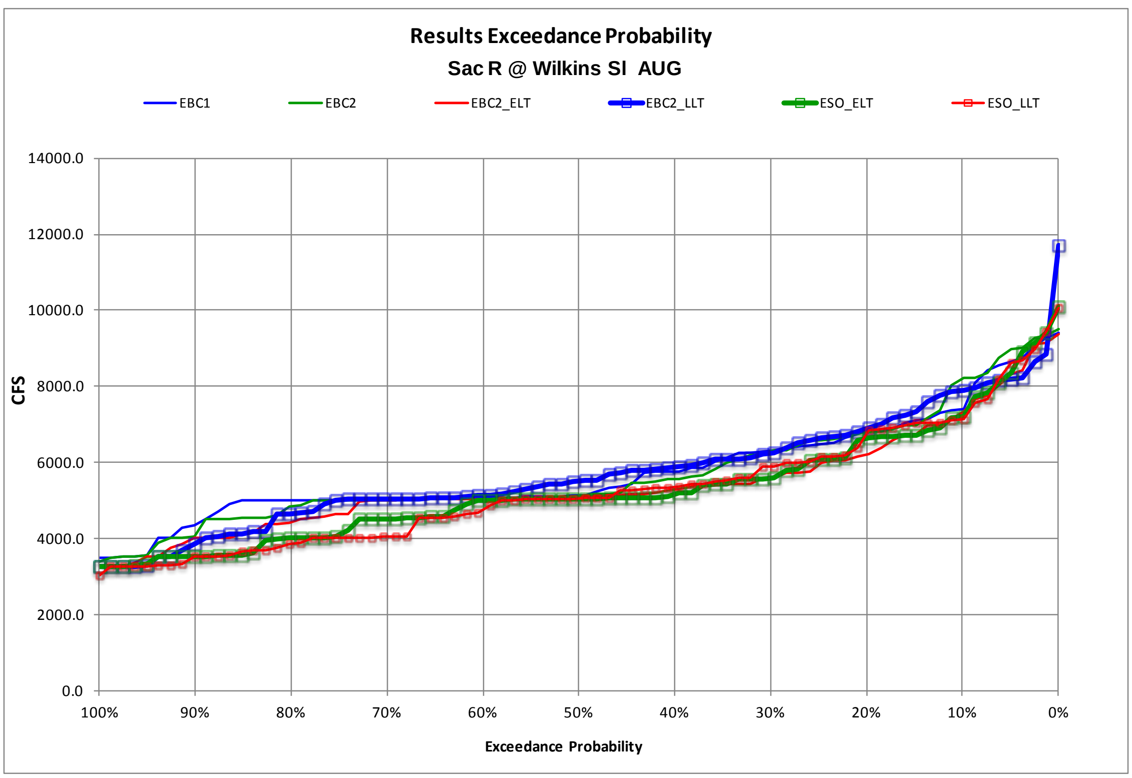


Figure 5C.5.2-61. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Wilkins Slough, August

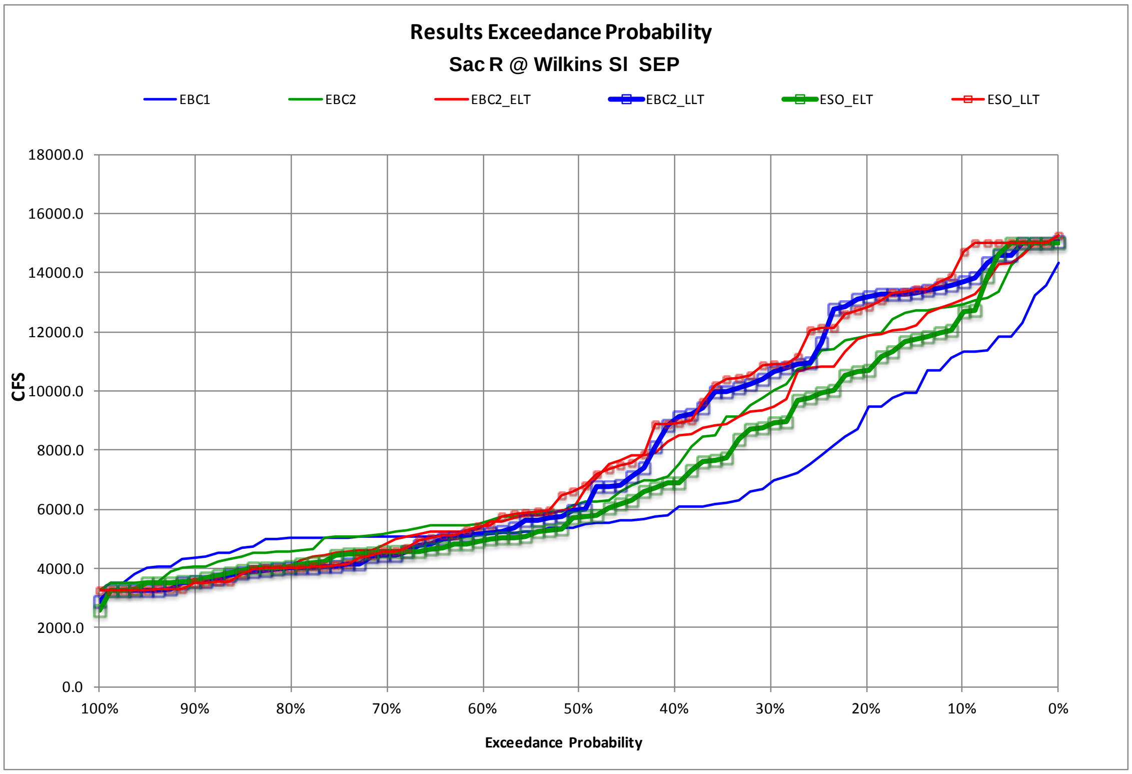


Figure 5C.5.2-62. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Wilkins Slough, September

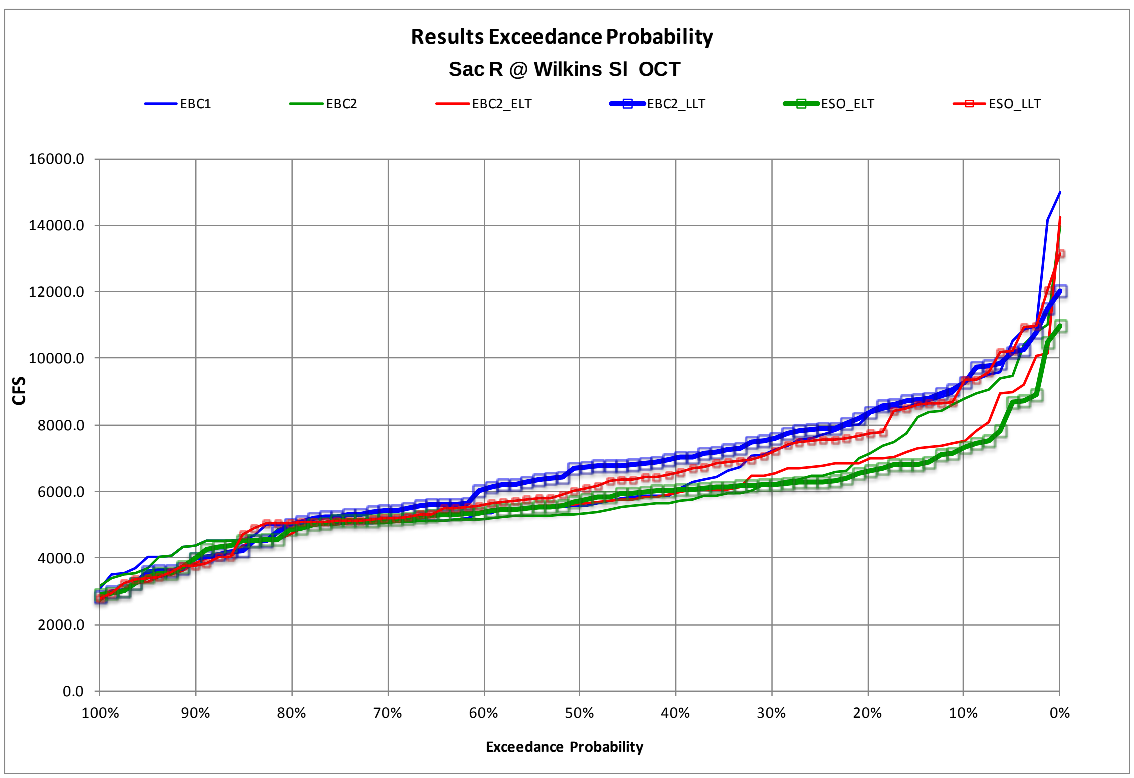


Figure 5C.5.2-63. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Wilkins Slough, October

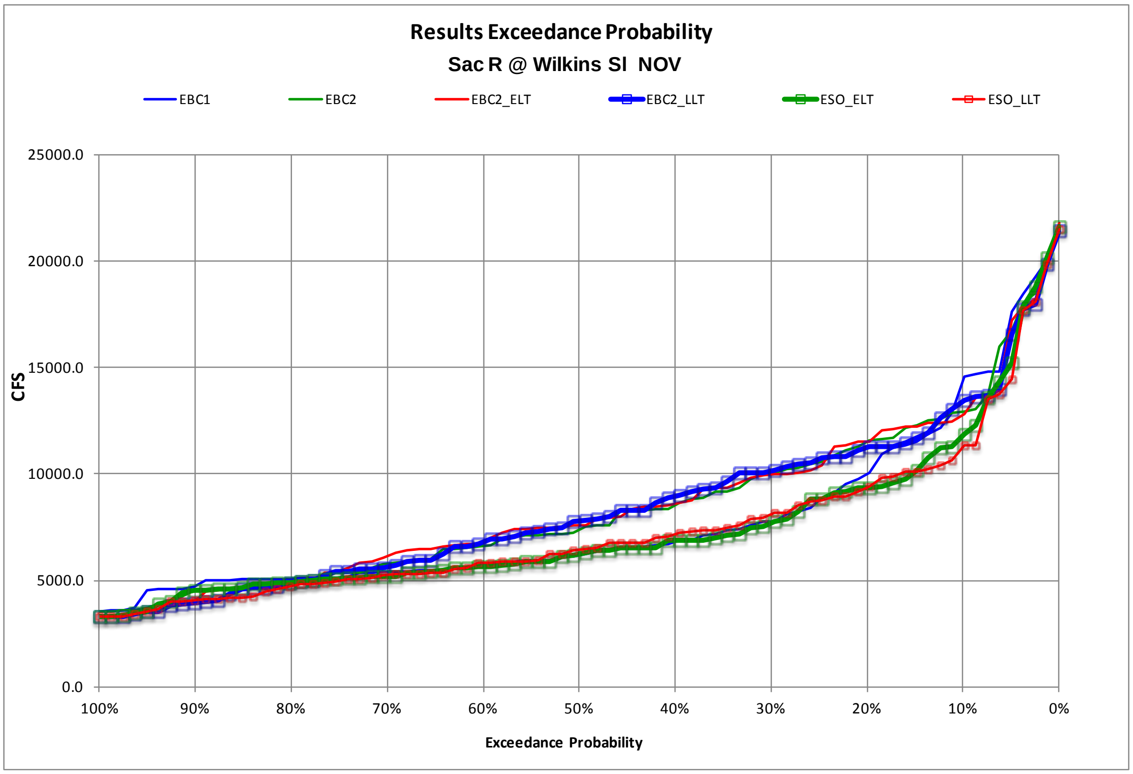


Figure 5C.5.2-64. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Wilkins Slough, November

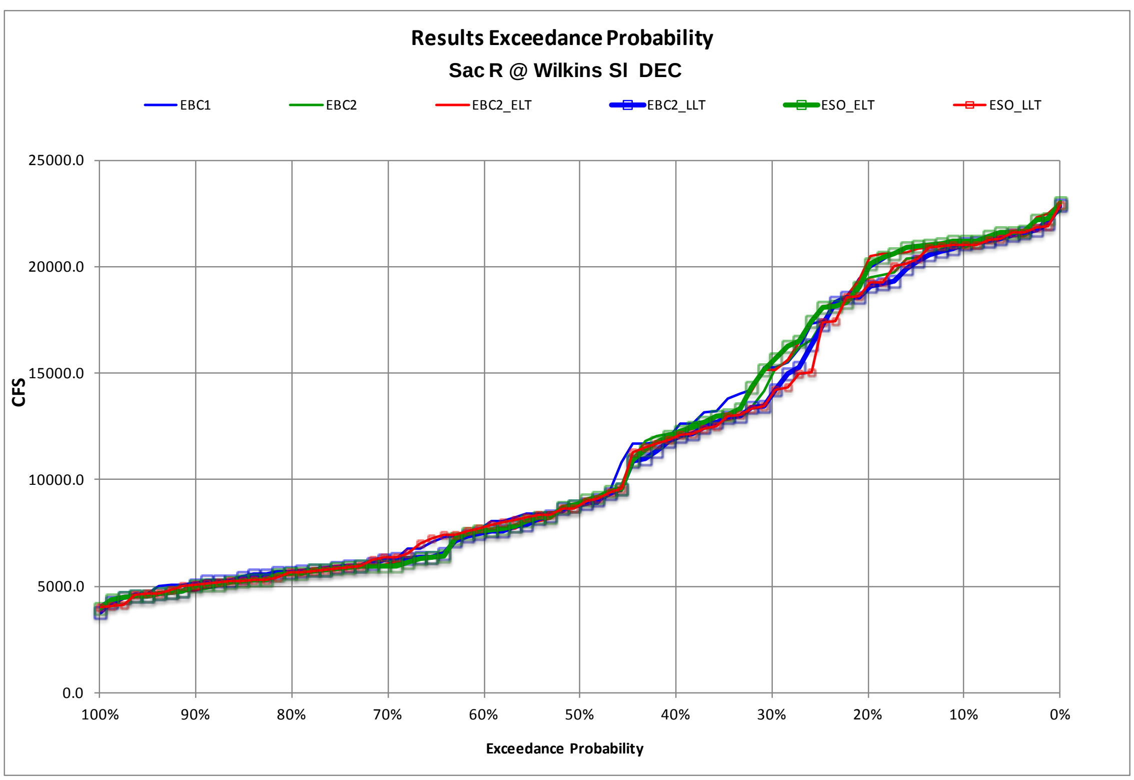


Figure 5C.5.2-65. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Wilkins Slough, December

Table 5C.5.2-60. Mean Monthly Flows (cfs) in the Sacramento River at Wilkins Slough for ESO, HOS, and LOS Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	19,275	19,359	19,267	19,348	19,274	19,383
	AN	16,611	16,553	16,596	16,423	17,183	17,295
	BN	12,640	12,270	12,592	12,502	12,647	12,682
	D	8,825	8,906	8,832	8,899	8,934	9,121
	C	7,860	8,744	7,864	7,861	8,513	9,125
	All	13,788	13,890	13,777	13,776	13,992	14,180
Feb	W	19,992	20,053	20,003	20,069	19,998	20,076
	AN	19,219	19,120	19,163	19,143	19,711	19,485
	BN	14,557	14,445	14,549	14,600	14,705	14,904
	D	11,451	11,471	11,400	11,494	11,430	11,451
	C	8,354	8,135	8,237	8,260	8,205	8,235
	All	15,373	15,331	15,339	15,389	15,446	15,480
Mar	W	18,323	18,324	18,328	18,331	18,328	18,330
	AN	17,712	17,686	17,706	17,526	17,725	17,775
	BN	11,673	11,462	11,591	11,382	11,967	12,032
	D	11,264	11,337	11,242	11,414	11,132	11,295
	C	8,386	8,426	8,232	8,285	8,387	8,526
	All	14,095	14,077	14,054	14,038	14,119	14,194
Apr	W	13,315	13,032	13,299	13,037	13,316	13,136
	AN	10,063	10,072	10,101	10,149	10,132	10,054
	BN	6,847	7,262	7,032	6,759	7,153	7,227
	D	5,217	5,342	5,037	5,059	5,253	5,331
	C	4,097	4,264	4,055	4,221	4,120	4,246
	All	8,608	8,642	8,595	8,501	8,682	8,662
May	W	9,447	8,826	9,429	8,579	9,433	8,843
	AN	7,820	8,652	7,481	8,393	7,817	8,411
	BN	5,315	5,712	4,942	4,960	5,675	5,870
	D	4,817	5,974	4,642	5,309	4,902	6,054
	C	4,177	4,728	4,260	4,613	4,431	4,717
	All	6,716	7,043	6,571	6,636	6,828	7,056
Jun	W	6,467	7,353	6,249	6,642	6,452	7,471
	AN	6,523	8,036	5,590	6,325	6,587	7,947
	BN	5,811	6,330	5,274	5,380	5,896	6,459
	D	6,212	6,758	5,570	6,011	6,045	6,706
	C	5,957	6,129	5,724	5,821	5,926	5,925
	All	6,233	6,968	5,760	6,122	6,211	6,974
Jul	W	7,367	7,838	7,224	7,910	7,370	7,897
	AN	7,304	7,667	7,369	7,541	7,274	7,783
	BN	6,873	6,378	6,462	6,242	6,483	6,348
	D	7,172	6,435	6,881	6,692	7,382	6,716
	C	6,708	6,366	6,100	6,449	6,511	6,175
	All	7,134	7,041	6,875	7,090	7,081	7,105

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Aug	W	5,548	5,482	5,657	5,891	5,575	5,393
	AN	6,063	6,280	6,251	6,950	5,886	6,393
	BN	5,755	5,350	5,695	5,930	5,434	5,070
	D	4,574	4,799	6,023	6,014	4,593	4,789
	C	4,578	4,524	4,850	4,726	4,452	5,153
	All	5,303	5,286	5,713	5,909	5,216	5,317
Sep	W	11,624	13,105	11,901	13,439	7,869	7,025
	AN	7,485	8,995	8,577	9,782	6,497	5,880
	BN	4,733	4,453	4,647	5,101	5,548	5,118
	D	4,269	4,783	4,445	4,895	4,785	4,872
	C	4,514	5,303	4,486	5,114	4,803	5,251
	All	7,187	8,058	7,454	8,386	6,146	5,800
Oct	W	6,840	7,240	6,982	7,093	6,944	6,932
	AN	5,523	6,943	6,102	7,937	5,902	6,640
	BN	5,196	5,935	5,584	5,800	5,566	6,148
	D	5,386	5,809	5,555	6,260	5,415	6,254
	C	4,902	5,531	5,351	5,543	5,346	6,096
	All	5,764	6,409	6,063	6,586	5,987	6,484
Nov	W	9,684	9,709	9,724	9,964	9,390	8,913
	AN	7,845	7,467	8,229	8,112	7,166	6,532
	BN	6,308	6,539	6,517	6,404	6,071	5,817
	D	6,528	6,394	6,483	6,445	6,541	6,042
	C	4,722	4,679	4,508	4,507	4,564	4,503
	All	7,419	7,376	7,483	7,514	7,166	6,761
Dec	W	17,877	17,141	17,919	17,372	18,102	17,548
	AN	10,833	10,981	10,943	10,991	10,779	11,071
	BN	8,306	8,458	8,324	8,277	8,330	8,613
	D	8,633	8,813	8,580	8,587	9,086	9,155
	C	6,122	6,010	5,991	5,993	6,196	6,192
	All	11,463	11,300	11,464	11,292	11,641	11,570

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-61. Differences[a] between ESO Scenarios and HOS and LOS Scenarios in Mean Monthly Flows (cfs) in the Sacramento River at Wilkins Slough

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	-8 (-0.04%)	-11 (-0.1%)	-1 (-0.005%)	25 (0.1%)
	AN	-16 (-0.1%)	-130 (-0.8%)	572 (3.4%)	742 (4.5%)
	BN	-48 (-0.4%)	231 (1.9%)	7 (0.1%)	412 (3.4%)
	D	6 (0.1%)	-7 (-0.1%)	109 (1.2%)	215 (2.4%)
	C	4 (0.05%)	-883 (-10.1%)	653 (8.3%)	381 (4.4%)
	All	-11 (-0.1%)	-114 (-0.8%)	204 (1.5%)	290 (2.1%)
Feb	W	11 (0.1%)	15 (0.1%)	6 (0.03%)	22 (0.1%)
	AN	-57 (-0.3%)	23 (0.1%)	491 (2.6%)	365 (1.9%)
	BN	-8 (-0.1%)	155 (1.1%)	147 (1%)	459 (3.2%)
	D	-51 (-0.4%)	23 (0.2%)	-21 (-0.2%)	-20 (-0.2%)
	C	-116 (-1.4%)	125 (1.5%)	-148 (-1.8%)	100 (1.2%)
	All	-34 (-0.2%)	58 (0.4%)	73 (0.5%)	149 (1%)
Mar	W	5 (0.03%)	7 (0.04%)	4 (0.02%)	6 (0.03%)
	AN	-6 (-0.03%)	-160 (-0.9%)	13 (0.1%)	89 (0.5%)
	BN	-82 (-0.7%)	-81 (-0.7%)	294 (2.5%)	569 (5%)
	D	-22 (-0.2%)	77 (0.7%)	-132 (-1.2%)	-41 (-0.4%)
	C	-154 (-1.8%)	-141 (-1.7%)	1 (0.01%)	100 (1.2%)
	All	-41 (-0.3%)	-39 (-0.3%)	25 (0.2%)	118 (0.8%)
Apr	W	-16 (-0.1%)	5 (0.04%)	0 (0%)	104 (0.8%)
	AN	38 (0.4%)	76 (0.8%)	69 (0.7%)	-18 (-0.2%)
	BN	185 (2.7%)	-503 (-6.9%)	306 (4.5%)	-35 (-0.5%)
	D	-180 (-3.4%)	-283 (-5.3%)	36 (0.7%)	-11 (-0.2%)
	C	-42 (-1%)	-43 (-1%)	23 (0.6%)	-18 (-0.4%)
	All	-14 (-0.2%)	-142 (-1.6%)	74 (0.9%)	19 (0.2%)
May	W	-18 (-0.2%)	-247 (-2.8%)	-14 (-0.2%)	17 (0.2%)
	AN	-338 (-4.3%)	-259 (-3%)	-2 (-0.03%)	-241 (-2.8%)
	BN	-372 (-7%)	-752 (-13.2%)	360 (6.8%)	158 (2.8%)
	D	-175 (-3.6%)	-665 (-11.1%)	85 (1.8%)	80 (1.3%)
	C	83 (2%)	-115 (-2.4%)	254 (6.1%)	-11 (-0.2%)
	All	-145 (-2.2%)	-407 (-5.8%)	113 (1.7%)	13 (0.2%)
Jun	W	-219 (-3.4%)	-710 (-9.7%)	-15 (-0.2%)	118 (1.6%)
	AN	-932 (-14.3%)	-1711 (-21.3%)	64 (1%)	-89 (-1.1%)
	BN	-537 (-9.2%)	-950 (-15%)	85 (1.5%)	130 (2%)
	D	-642 (-10.3%)	-747 (-11%)	-167 (-2.7%)	-52 (-0.8%)
	C	-233 (-3.9%)	-308 (-5%)	-31 (-0.5%)	-203 (-3.3%)
	All	-472 (-7.6%)	-847 (-12.2%)	-22 (-0.4%)	5 (0.1%)
Jul	W	-143 (-1.9%)	72 (0.9%)	3 (0.04%)	59 (0.8%)
	AN	64 (0.9%)	-126 (-1.6%)	-30 (-0.4%)	115 (1.5%)
	BN	-412 (-6%)	-136 (-2.1%)	-391 (-5.7%)	-30 (-0.5%)
	D	-292 (-4.1%)	257 (4%)	209 (2.9%)	281 (4.4%)
	C	-608 (-9.1%)	83 (1.3%)	-198 (-2.9%)	-191 (-3%)
	All	-259 (-3.6%)	50 (0.7%)	-53 (-0.7%)	64 (0.9%)

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	109 (2%)	409 (7.5%)	27 (0.5%)	-89 (-1.6%)
	AN	187 (3.1%)	670 (10.7%)	-178 (-2.9%)	112 (1.8%)
	BN	-59 (-1%)	579 (10.8%)	-321 (-5.6%)	-280 (-5.2%)
	D	1449 (31.7%)	1215 (25.3%)	19 (0.4%)	-10 (-0.2%)
	C	272 (5.9%)	202 (4.5%)	-127 (-2.8%)	628 (13.9%)
	All	410 (7.7%)	623 (11.8%)	-87 (-1.6%)	30 (0.6%)
Sep	W	276 (2.4%)	334 (2.5%)	-3756 (-32.3%)	-6080 (-46.4%)
	AN	1093 (14.6%)	787 (8.7%)	-987 (-13.2%)	-3115 (-34.6%)
	BN	-86 (-1.8%)	648 (14.6%)	815 (17.2%)	665 (14.9%)
	D	176 (4.1%)	112 (2.3%)	516 (12.1%)	89 (1.9%)
	C	-28 (-0.6%)	-189 (-3.6%)	290 (6.4%)	-52 (-1%)
	All	267 (3.7%)	328 (4.1%)	-1040 (-14.5%)	-2258 (-28%)
Oct	W	142 (2.1%)	-147 (-2%)	104 (1.5%)	-308 (-4.3%)
	AN	579 (10.5%)	994 (14.3%)	379 (6.9%)	-303 (-4.4%)
	BN	387 (7.5%)	-135 (-2.3%)	370 (7.1%)	212 (3.6%)
	D	169 (3.1%)	451 (7.8%)	28 (0.5%)	446 (7.7%)
	C	449 (9.2%)	12 (0.2%)	443 (9%)	565 (10.2%)
	All	299 (5.2%)	176 (2.8%)	223 (3.9%)	75 (1.2%)
Nov	W	41 (0.4%)	254 (2.6%)	-293 (-3%)	-796 (-8.2%)
	AN	384 (4.9%)	645 (8.6%)	-679 (-8.7%)	-935 (-12.5%)
	BN	209 (3.3%)	-134 (-2.1%)	-237 (-3.8%)	-721 (-11%)
	D	-44 (-0.7%)	51 (0.8%)	13 (0.2%)	-352 (-5.5%)
	C	-214 (-4.5%)	-172 (-3.7%)	-158 (-3.3%)	-177 (-3.8%)
	All	64 (0.9%)	138 (1.9%)	-253 (-3.4%)	-616 (-8.3%)
Dec	W	42 (0.2%)	231 (1.3%)	225 (1.3%)	407 (2.4%)
	AN	110 (1%)	9 (0.1%)	-54 (-0.5%)	89 (0.8%)
	BN	17 (0.2%)	-180 (-2.1%)	23 (0.3%)	156 (1.8%)
	D	-54 (-0.6%)	-226 (-2.6%)	452 (5.2%)	342 (3.9%)
	C	-131 (-2.1%)	-17 (-0.3%)	73 (1.2%)	181 (3%)
	All	1 (0.01%)	-8 (-0.1%)	178 (1.5%)	270 (2.4%)

[a] Positive values indicate greater monthly flows under HOS or LOS than under ESO
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Water Temperature

Changes in flow and other factors potentially affect water temperatures in splittail upstream spawning and rearing habitat. Feyrer et al. (2005) found no evidence that temperature was an important factor in habitat selection for rearing splittail in their upstream habitats. However, mean monthly water temperatures were examined in the Sacramento River at Hamilton City, a representative site for splittail spawning and rearing, during February through June. Year-round water temperatures are presented in Table 5C.5.2-62 and differences between pairs of scenarios are presented in Table 5C.5.2-63. These results indicate that there would be very small (<2%) differences in water temperature in the Sacramento River at Hamilton City in all months and water-year types between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. The largest difference in average temperature would be an increase of 1.2°F, or 1.8%, which would occur in dry years during August. Even this largest difference would not be meaningful to splittail spawning and rearing. Similarly, there would be no increases in water temperatures at Hamilton City from ESO to HOS or LOS scenarios during the February through June upstream spawning and rearing period (Table 5C.5.2-64, Table 5C.5.2-65). Because no differences in temperatures were found, no further temperature analyses on splittail are reported.

Table 5C.5.2-62. Mean Monthly Water Temperature (°F) in the Sacramento River at Hamilton City under EBC and ESO Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	45	45	46	47	46	47
	AN	45	45	46	47	46	47
	BN	44	44	45	46	45	46
	D	44	44	45	46	45	46
	C	44	44	45	47	45	47
	All	45	45	45	47	45	47
Feb	W	46	46	47	48	47	48
	AN	47	47	48	48	48	48
	BN	46	46	47	48	47	48
	D	47	47	48	49	48	49
	C	48	48	49	50	49	50
	All	47	47	48	49	48	49
Mar	W	49	49	50	51	50	51
	AN	51	51	51	52	51	52
	BN	51	51	52	53	52	53
	D	52	52	52	54	53	53
	C	52	52	53	54	53	54
	All	51	51	52	52	51	52
Apr	W	54	54	54	55	54	56
	AN	55	55	56	57	56	57
	BN	56	56	57	58	57	58
	D	56	56	57	58	57	58
	C	56	56	57	58	57	58
	All	55	55	56	57	56	57
May	W	58	58	60	62	60	61
	AN	60	60	61	62	61	61
	BN	59	59	61	62	61	61
	D	59	59	61	61	60	60
	C	60	60	61	62	61	62
	All	59	59	61	62	60	61
Jun	W	61	61	62	63	62	62
	AN	61	60	62	62	61	61
	BN	60	60	61	62	61	62
	D	60	61	62	63	61	62
	C	61	61	62	63	62	63
	All	61	61	62	63	62	62

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jul	W	62	62	62	63	62	63
	AN	61	61	62	63	62	63
	BN	61	61	62	63	62	64
	D	61	61	62	64	62	65
	C	63	63	65	68	65	68
	All	62	62	63	64	63	64
Aug	W	62	62	64	65	64	65
	AN	62	62	63	64	63	65
	BN	62	62	63	65	63	65
	D	62	62	64	65	65	66
	C	65	65	68	71	68	72
	All	62	62	64	66	64	66
Sep	W	60	59	60	61	60	61
	AN	62	61	61	63	62	63
	BN	62	62	63	65	64	66
	D	62	63	65	67	65	67
	C	64	64	67	69	67	69
	All	62	61	63	65	63	65
Oct	W	55	56	57	58	57	58
	AN	56	56	57	58	57	58
	BN	56	56	57	59	58	59
	D	56	56	58	59	58	59
	C	57	57	59	60	59	60
	All	56	56	57	59	57	59
Nov	W	50	50	51	53	51	52
	AN	50	50	51	53	51	53
	BN	50	51	52	53	51	53
	D	51	51	52	53	52	53
	C	52	52	53	54	53	54
	All	51	51	52	53	52	53
Dec	W	46	46	47	47	47	47
	AN	46	46	46	48	46	48
	BN	45	45	46	48	46	48
	D	45	45	46	48	46	48
	C	45	45	46	48	46	48
	All	46	45	46	47	46	47

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-63. Differences[a] between EBC and ESO Scenarios in Mean Monthly Water Temperature (°F) in the Sacramento River at Hamilton City

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	1 (1.6%)	2 (3.6%)	1 (1.8%)	2 (3.7%)	0 (0%)	0 (0%)
	AN	1 (1.8%)	2 (3.9%)	1 (1.9%)	2 (4%)	0 (0%)	0 (0%)
	BN	1 (2.1%)	2 (4.4%)	1 (2.1%)	2 (4.5%)	0 (0%)	0 (0%)
	D	1 (2.1%)	2 (4.8%)	1 (2.2%)	2 (4.9%)	0 (0%)	0 (-0.1%)
	C	1 (2.4%)	2 (5.6%)	1 (2.4%)	2 (5.5%)	-0.1 (-0.2%)	0 (0%)
	All	1 (1.9%)	2 (4.3%)	1 (2%)	2 (4.4%)	0 (0%)	0 (0%)
Feb	W	1 (1.9%)	2 (3.6%)	1 (1.9%)	2 (3.6%)	0 (0%)	0 (0%)
	AN	1 (1.9%)	2 (3.7%)	1 (1.9%)	2 (3.8%)	0 (0%)	0 (0%)
	BN	1 (2.1%)	2 (4%)	1 (2.1%)	2 (4%)	0 (0%)	-0.03 (-0.1%)
	D	1 (2.4%)	2 (4.4%)	1 (2.4%)	2 (4.4%)	0 (0%)	0 (0%)
	C	1 (2.4%)	2 (4.7%)	1 (2.4%)	2 (4.7%)	0 (0%)	-0.03 (-0.1%)
	All	1 (2.1%)	2 (4%)	1 (2.1%)	2 (4%)	0 (0%)	0 (0%)
Mar	W	1 (1.3%)	2 (3.1%)	1 (1.4%)	2 (3.1%)	0 (0%)	0 (0%)
	AN	1 (1.4%)	2 (3.3%)	1 (1.2%)	2 (3.2%)	-0.03 (-0.1%)	0 (0%)
	BN	1 (1.6%)	2 (3.7%)	1 (1.5%)	2 (3.7%)	0 (0%)	0.03 (0.1%)
	D	1 (1.6%)	2 (3.5%)	1 (1.6%)	2 (3.5%)	0 (0%)	-0.04 (-0.1%)
	C	1 (1.3%)	2 (3.3%)	1 (1.4%)	2 (3.5%)	-0.1 (-0.1%)	-0.2 (-0.3%)
	All	1 (1.4%)	2 (3.3%)	1 (1.4%)	2 (3.4%)	0 (0%)	0 (0%)
Apr	W	1 (1.6%)	2 (3.5%)	1 (1.5%)	2 (3.5%)	0 (0%)	0.03 (0.1%)
	AN	1 (1.5%)	2 (3.6%)	1 (1.5%)	2 (3.5%)	0 (0%)	-0.1 (-0.2%)
	BN	1 (1.8%)	2 (3.3%)	1 (1.5%)	2 (3.1%)	0 (0%)	-0.2 (-0.3%)
	D	1 (1.5%)	2 (3.4%)	1 (1.3%)	2 (3.2%)	-0.1 (-0.1%)	-0.2 (-0.3%)
	C	1 (1.7%)	2 (3.7%)	1 (1.4%)	2 (3.4%)	0 (0%)	-0.04 (-0.1%)
	All	1 (1.6%)	2 (3.5%)	1 (1.5%)	2 (3.4%)	0 (0%)	-0.1 (-0.1%)
May	W	2 (3.2%)	3 (5.1%)	2 (3.2%)	3 (5.1%)	0 (0%)	-0.3 (-0.4%)
	AN	1 (1.5%)	1 (2.3%)	1 (1.5%)	1 (2.3%)	-1 (-0.9%)	-1 (-1.1%)
	BN	1 (2.5%)	2 (3.3%)	1 (2.3%)	2 (3.1%)	-0.2 (-0.4%)	-1 (-0.9%)
	D	1 (2.1%)	1 (2.4%)	1 (1.9%)	1 (2.2%)	-0.3 (-0.5%)	-1 (-1%)
	C	1 (2.1%)	2 (3.4%)	1 (2%)	2 (3.3%)	0 (0%)	0 (0%)
	All	1 (2.4%)	2 (3.5%)	1 (2.3%)	2 (3.4%)	-0.2 (-0.3%)	-0.4 (-0.7%)
Jun	W	1 (1.7%)	1 (2.2%)	1 (1.7%)	1 (2.3%)	-0.1 (-0.2%)	-1 (-0.9%)
	AN	1 (1.2%)	1 (1.3%)	1 (1.4%)	1 (1.5%)	-0.3 (-0.5%)	-1 (-1.5%)
	BN	1 (1.3%)	2 (2.5%)	1 (1.4%)	2 (2.6%)	-0.3 (-0.6%)	-1 (-0.8%)
	D	1 (1.4%)	2 (3%)	1 (1.3%)	2 (2.9%)	-0.4 (-0.6%)	-0.4 (-0.6%)
	C	1 (1.3%)	2 (3.7%)	1 (1.5%)	2 (3.8%)	-0.2 (-0.3%)	0.1 (0.2%)
	All	1 (1.4%)	2 (2.5%)	1 (1.5%)	2 (2.6%)	-0.3 (-0.4%)	-0.5 (-0.7%)
Jul	W	0 (0.6%)	1 (2.1%)	0 (0.8%)	1 (2.3%)	-0.1 (-0.2%)	0 (0%)
	AN	1 (1.2%)	2 (3.1%)	1 (1.5%)	2 (3.3%)	0.05 (0.1%)	0.2 (0.4%)
	BN	1 (1%)	2 (3.9%)	1 (1.1%)	2 (4%)	-0.2 (-0.4%)	0.3 (0.5%)
	D	1 (1.8%)	3 (5.5%)	1 (1.8%)	3 (5.5%)	0.1 (0.2%)	1 (1.4%)
	C	2 (3.3%)	5 (7.7%)	2 (2.7%)	4 (7.1%)	-0.1 (-0.2%)	0.04 (0.1%)
	All	1 (1.4%)	3 (4.1%)	1 (1.5%)	3 (4.1%)	-0.1 (-0.1%)	0.3 (0.5%)

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Aug	W	2 (2.7%)	3 (5.4%)	2 (2.6%)	3 (5.3%)	0 (0%)	0.1 (0.2%)
	AN	1 (1.4%)	3 (4.1%)	1 (1.6%)	3 (4.3%)	-0.1 (-0.2%)	0.5 (0.7%)
	BN	1 (1.9%)	3 (5.5%)	1 (2%)	3 (5.5%)	-0.4 (-0.6%)	0.4 (0.6%)
	D	3 (4%)	4 (7%)	3 (4.1%)	4 (7%)	1 (1.3%)	1 (1.8%)
	C	3 (4.9%)	7 (10.8%)	3 (4.7%)	7 (10.6%)	0 (0%)	0.3 (0.5%)
	All	2 (3%)	4 (6.4%)	2 (3%)	4 (6.4%)	0.1 (0.1%)	0.5 (0.7%)
Sep	W	0 (0.2%)	1 (1.9%)	1 (2.4%)	2 (4.2%)	0.2 (0.3%)	0.05 (0.1%)
	AN	0 (0.5%)	1 (2.2%)	2 (2.9%)	3 (4.7%)	1 (1.6%)	1 (0.9%)
	BN	2 (3.2%)	4 (6.7%)	2 (3.2%)	4 (6.7%)	1 (1%)	1 (1.5%)
	D	3 (4.8%)	5 (7.6%)	3 (4.2%)	4 (7%)	0.3 (0.5%)	-0.4 (-0.6%)
	C	3 (4%)	5 (7.6%)	3 (4%)	5 (7.6%)	0 (0%)	-0.1 (-0.1%)
	All	1 (2.3%)	3 (4.9%)	2 (3.3%)	4 (5.8%)	0.4 (0.6%)	0.2 (0.3%)
Oct	W	1 (2.5%)	3 (5.1%)	1 (2.2%)	3 (4.8%)	0.04 (0.1%)	0.1 (0.2%)
	AN	1 (2.7%)	3 (4.9%)	1 (2.1%)	2 (4.2%)	0.1 (0.1%)	0.05 (0.1%)
	BN	2 (2.7%)	3 (5.6%)	1 (2.4%)	3 (5.2%)	0.05 (0.1%)	0.2 (0.4%)
	D	1 (2.6%)	3 (5.5%)	1 (2.4%)	3 (5.3%)	0.05 (0.1%)	0.1 (0.2%)
	C	1 (2.6%)	3 (5.7%)	1 (2.6%)	3 (5.8%)	-0.2 (-0.3%)	0.03 (0.1%)
	All	1 (2.6%)	3 (5.3%)	1 (2.3%)	3 (5%)	0 (0%)	0.1 (0.2%)
Nov	W	1 (1.9%)	2 (4.6%)	1 (1.4%)	2 (4%)	-0.2 (-0.4%)	-0.1 (-0.2%)
	AN	1 (1.9%)	2 (4.7%)	1 (1.8%)	2 (4.6%)	-0.2 (-0.4%)	-0.1 (-0.1%)
	BN	1 (1.8%)	3 (5%)	1 (1.4%)	2 (4.5%)	-0.3 (-0.6%)	-0.1 (-0.3%)
	D	1 (1.9%)	2 (4.6%)	1 (1.8%)	2 (4.5%)	-0.2 (-0.3%)	-0.1 (-0.2%)
	C	1 (2.1%)	2 (4.8%)	1 (2%)	2 (4.7%)	-0.1 (-0.2%)	-0.1 (-0.2%)
	All	1 (1.9%)	2 (4.7%)	1 (1.6%)	2 (4.4%)	-0.2 (-0.4%)	-0.1 (-0.2%)
Dec	W	1 (1.4%)	1 (3%)	1 (1.9%)	2 (3.5%)	0 (0%)	-0.1 (-0.1%)
	AN	1 (1.8%)	2 (4.4%)	1 (1.7%)	2 (4.3%)	-0.1 (-0.3%)	0 (0%)
	BN	1 (1.9%)	2 (4.8%)	1 (2.1%)	2 (5%)	-0.1 (-0.2%)	0.1 (0.1%)
	D	1 (1.9%)	2 (4.7%)	1 (2%)	2 (4.8%)	-0.1 (-0.1%)	-0.03 (-0.1%)
	C	1 (2.2%)	2 (4.9%)	1 (2.5%)	2 (5.2%)	0.04 (0.1%)	0 (0%)
	All	1 (1.8%)	2 (4.2%)	1 (2%)	2 (4.4%)	-0.04 (-0.1%)	0 (0%)

[a] Positive values indicate higher temperatures under ESO than under EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

1 **Table 5C.5.2-64. Mean Monthly Water Temperature (°F) in the Sacramento River at Hamilton City**
2 **under ESO, HOS, and LOS Scenarios**

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	46	47	46	47	46	47
	AN	46	47	46	47	46	47
	BN	45	46	45	46	45	46
	D	45	46	45	46	45	46
	C	45	47	46	47	46	47
	All	45	47	46	47	46	47
Feb	W	47	48	47	48	47	48
	AN	48	48	48	48	48	48
	BN	47	48	47	48	47	48
	D	48	49	48	49	48	49
	C	49	50	49	50	49	50
	All	48	49	48	49	48	49
Mar	W	50	51	50	51	50	51
	AN	51	52	51	52	51	52
	BN	52	53	52	53	52	53
	D	53	53	53	54	53	53
	C	53	54	53	54	53	54
	All	51	52	52	52	51	52
Apr	W	54	56	54	55	54	55
	AN	56	57	56	57	56	57
	BN	57	58	57	58	57	58
	D	57	58	57	58	57	58
	C	57	58	57	58	57	58
	All	56	57	56	57	56	57
May	W	60	61	60	61	60	61
	AN	61	61	61	61	61	61
	BN	61	61	61	62	61	61
	D	60	60	60	61	60	60
	C	61	62	61	62	61	62
	All	60	61	61	61	60	61
Jun	W	62	62	62	63	62	62
	AN	61	61	62	62	61	62
	BN	61	62	61	62	61	62
	D	61	62	62	63	61	62
	C	62	63	62	64	62	64
	All	62	62	62	63	61	62
Jul	W	62	63	62	63	62	63
	AN	62	63	61	63	62	63
	BN	62	64	62	63	62	64
	D	62	65	62	64	62	64
	C	65	68	65	67	65	68
	All	63	64	63	64	63	64

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Aug	W	64	65	64	65	64	65
	AN	63	65	63	64	63	65
	BN	63	65	63	65	63	65
	D	65	66	64	65	65	66
	C	68	72	67	70	68	71
	All	64	66	64	66	64	66
Sep	W	60	61	60	61	62	64
	AN	62	63	62	63	63	65
	BN	64	66	64	65	63	65
	D	65	67	65	66	65	67
	C	67	69	66	69	67	69
	All	63	65	63	64	64	66
Oct	W	57	58	57	58	57	58
	AN	57	58	57	58	57	58
	BN	58	59	57	59	57	59
	D	58	59	58	59	58	59
	C	59	60	58	60	59	60
	All	57	59	57	59	57	59
Nov	W	51	52	51	52	51	52
	AN	51	53	51	53	51	52
	BN	51	53	51	53	51	53
	D	52	53	52	53	52	53
	C	53	54	52	54	53	54
	All	52	53	52	53	51	53
Dec	W	47	47	47	47	47	47
	AN	46	48	46	48	46	47
	BN	46	48	46	47	46	48
	D	46	48	46	48	46	48
	C	46	48	46	48	46	48
	All	46	47	46	47	46	48

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

1 **Table 5C.5.2-65. Differences[a] between ESO Scenarios and HOS and LOS Scenarios in Mean Monthly**
2 **Water Temperature (°F) in the Sacramento River at Hamilton City**

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	0 (0%)	0 (0%)	0.04 (0.1%)	0.1 (0.2%)
	AN	0.03 (0.1%)	0 (0%)	0 (0%)	0.1 (0.2%)
	BN	0 (0%)	0.04 (0.1%)	0 (0%)	0.1 (0.1%)
	D	0.04 (0.1%)	-0.03 (-0.1%)	0.1 (0.1%)	0.1 (0.1%)
	C	0.1 (0.2%)	-0.1 (-0.3%)	0.2 (0.4%)	0.03 (0.1%)
	All	0.03 (0.1%)	0 (0%)	0.1 (0.1%)	0.1 (0.1%)
Feb	W	0 (0%)	0 (0%)	0 (0%)	0.02 (0.1%)
	AN	0 (0%)	0 (0%)	0 (0%)	0.03 (0.1%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0.04 (0.1%)	0 (0%)	0 (0%)	0 (0%)
	C	0.1 (0.2%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0.05 (0.1%)	0 (0%)	-0.04 (-0.1%)
	BN	0 (0%)	0.1 (0.1%)	-0.1 (-0.2%)	-0.2 (-0.3%)
	D	0 (0%)	0.03 (0.1%)	0 (0%)	0 (0%)
	C	0.1 (0.1%)	0.1 (0.2%)	0 (0%)	0 (0%)
	All	0 (0%)	0.04 (0.1%)	0 (0%)	-0.03 (-0.1%)
Apr	W	0 (0%)	0 (0%)	0 (0%)	-0.03 (-0.1%)
	AN	-0.03 (-0.1%)	0 (0%)	0 (0%)	0 (0%)
	BN	-0.03 (-0.1%)	0.3 (0.5%)	-0.1 (-0.2%)	0.04 (0.1%)
	D	0.1 (0.2%)	0.2 (0.3%)	-0.03 (-0.1%)	0.1 (0.1%)
	C	0.1 (0.2%)	-0.04 (-0.1%)	-0.03 (-0.1%)	0 (0%)
	All	0 (0%)	0.1 (0.1%)	-0.03 (-0.1%)	0 (0%)
May	W	0 (0%)	0.2 (0.3%)	0 (0%)	0 (0%)
	AN	0.2 (0.3%)	0.3 (0.5%)	0 (0%)	0.2 (0.3%)
	BN	0.3 (0.4%)	0.6 (1%)	-0.2 (-0.3%)	-0.1 (-0.2%)
	D	0.2 (0.3%)	0.5 (0.8%)	-0.1 (-0.1%)	-0.1 (-0.2%)
	C	-0.1 (-0.1%)	-0.1 (-0.2%)	-0.2 (-0.3%)	-0.03 (-0.1%)
	All	0.1 (0.2%)	0.3 (0.5%)	-0.1 (-0.1%)	0 (0%)
Jun	W	0.1 (0.2%)	0.5 (0.7%)	0 (0%)	-0.1 (-0.1%)
	AN	0.5 (0.9%)	1 (1.7%)	0 (0%)	0.1 (0.2%)
	BN	0.3 (0.5%)	0.5 (0.9%)	-0.03 (-0.1%)	-0.1 (-0.2%)
	D	0.3 (0.5%)	0.4 (0.7%)	-0.03 (-0.1%)	-0.1 (-0.1%)
	C	0 (0%)	0.1 (0.1%)	-0.1 (-0.1%)	0.2 (0.3%)
	All	0.2 (0.4%)	0.5 (0.8%)	0 (0%)	0 (0%)
Jul	W	0.1 (0.1%)	0 (0%)	0 (0%)	0 (0%)
	AN	-0.2 (-0.3%)	-0.03 (-0.1%)	0.1 (0.1%)	-0.03 (-0.1%)
	BN	0.2 (0.3%)	-0.1 (-0.2%)	0.3 (0.4%)	0.1 (0.1%)
	D	0.1 (0.2%)	-0.6 (-1%)	-0.2 (-0.3%)	-0.3 (-0.5%)
	C	-0.1 (-0.2%)	-0.8 (-1.1%)	0.1 (0.2%)	0 (0%)
	All	0.03 (0.1%)	-0.3 (-0.4%)	0 (0%)	-0.1 (-0.1%)

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	-0.1 (-0.2%)	-0.3 (-0.5%)	-0.04 (-0.1%)	0.1 (0.1%)
	AN	-0.2 (-0.4%)	-0.7 (-1.1%)	0.1 (0.2%)	-0.1 (-0.1%)
	BN	-0.1 (-0.1%)	-0.5 (-0.8%)	0.2 (0.4%)	0.2 (0.3%)
	D	-1.1 (-1.7%)	-1.1 (-1.6%)	0.1 (0.2%)	-0.1 (-0.1%)
	C	-0.9 (-1.4%)	-1.1 (-1.6%)	0.2 (0.3%)	-0.5 (-0.6%)
	All	-0.5 (-0.7%)	-0.7 (-1.1%)	0.1 (0.2%)	-0.04 (-0.1%)
Sep	W	-0.1 (-0.2%)	-0.2 (-0.4%)	1.8 (3.1%)	3.1 (5%)
	AN	-0.6 (-1%)	-0.6 (-0.9%)	0.5 (0.9%)	1.8 (2.8%)
	BN	0.1 (0.1%)	-0.6 (-0.9%)	-0.8 (-1.2%)	-0.7 (-1.1%)
	D	-0.4 (-0.6%)	-0.5 (-0.7%)	-0.4 (-0.7%)	-0.3 (-0.4%)
	C	-0.7 (-1.1%)	-0.6 (-0.8%)	-0.2 (-0.3%)	-0.2 (-0.2%)
	All	-0.3 (-0.5%)	-0.4 (-0.7%)	0.4 (0.6%)	1 (1.6%)
Oct	W	-0.1 (-0.1%)	0 (0%)	-0.1 (-0.2%)	-0.2 (-0.3%)
	AN	-0.1 (-0.2%)	-0.1 (-0.1%)	-0.2 (-0.4%)	-0.2 (-0.3%)
	BN	-0.2 (-0.3%)	-0.2 (-0.3%)	-0.1 (-0.3%)	-0.3 (-0.4%)
	D	-0.2 (-0.3%)	-0.2 (-0.4%)	0 (0%)	-0.2 (-0.4%)
	C	-0.4 (-0.7%)	-0.2 (-0.4%)	-0.1 (-0.1%)	-0.2 (-0.3%)
	All	-0.2 (-0.3%)	-0.1 (-0.2%)	-0.1 (-0.2%)	-0.2 (-0.3%)
Nov	W	0 (0%)	0 (0%)	-0.1 (-0.1%)	-0.2 (-0.4%)
	AN	0.1 (0.2%)	0.03 (0.1%)	-0.1 (-0.2%)	-0.2 (-0.4%)
	BN	0.03 (0.1%)	-0.1 (-0.1%)	-0.1 (-0.1%)	-0.2 (-0.5%)
	D	-0.03 (-0.1%)	0 (0%)	-0.04 (-0.1%)	-0.2 (-0.3%)
	C	-0.1 (-0.2%)	-0.1 (-0.1%)	-0.05 (-0.1%)	-0.1 (-0.1%)
	All	0 (0%)	0 (0%)	-0.1 (-0.1%)	-0.2 (-0.3%)
Dec	W	0.1 (0.1%)	0.05 (0.1%)	0.2 (0.3%)	0.2 (0.5%)
	AN	0.1 (0.1%)	0.04 (0.1%)	-0.1 (-0.2%)	-0.1 (-0.1%)
	BN	0 (0%)	-0.1 (-0.2%)	0 (0%)	0.04 (0.1%)
	D	0 (0%)	-0.1 (-0.2%)	0.1 (0.3%)	0.1 (0.2%)
	C	-0.1 (-0.1%)	0 (0%)	0.04 (0.1%)	0.1 (0.2%)
	All	0 (0%)	0 (0%)	0.1 (0.2%)	0.1 (0.2%)

[a] Positive value indicates higher water temperature under HOS or LOS than under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

5C.5.2.1.6 White Sturgeon

5C.5.2.1.6.1 Egg/Embryo

Water Temperature

White sturgeon spawning and egg incubation occurs from February through May in the Sacramento River between Verona and several kilometers upstream of Colusa (Kohlhorst 1976). Hamilton City was selected as a surrogate for white sturgeon spawning habitat because no SRWQM nodes are available further downstream where white sturgeon are expected to spawn. Predicted mean monthly water temperatures by water-year type at Hamilton City are presented in Table 5C.5.2-62 and differences between pairs of model scenarios are presented in Table 5C.5.2-63. These results indicate that there would be negligible differences between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT in mean monthly water temperatures regardless of month and water-year type in the Sacramento River at Hamilton City during February through May. Similarly, there would be no increases in water temperatures at Hamilton City from ESO to HOS or LOS scenarios during the February through May period (Table 5C.5.2-64, Table 5C.5.2-65).

The exceedances of daily water temperatures above 61°F and 68°F at Hamilton City during March through June, as requested by NMFS, were evaluated for white sturgeon spawning and egg incubation conditions (Section 5C.4, Table 5C.4-3). Water temperatures below the 61°F threshold represent optimal conditions for white sturgeon spawning and egg incubation, and 68°F represents a lethal threshold above which mortality would occur. In addition, the number of days on which temperature exceeded 61°F and 68°F by >0.5°F to >5°F in 0.5°F increments was determined for each month (March through June) and year of the 82-year modeling period. The combination of number of days and degrees above the 61°F and 68°F thresholds were further assigned a "level of concern", as defined in Section 5C.4, Table 5C.4-4. The highest level of concern was taken for each of the 82 modeled years and presented in Table 5C.5.2-66. Differences between model scenarios are presented in Table 5C.5.2-67. Results for the 61°F (optimal) threshold indicate that there would be a small shift in the number of years designated as red and orange levels of concern under EBC2_ELT and EBC2_LLT to yellow or no levels of concern under ESO_ELT and ESO_LLT, respectively. This indicates that there would be small beneficial temperature-related effects of the ESO to white sturgeon optimal spawning and egg incubation conditions in the Sacramento River. Lethal conditions (>68°F) to white sturgeon spawning and egg incubation would generally not occur under any model scenario; therefore, there would be no effect of the ESO on temperature-related mortality in the Sacramento River during spawning and egg incubation for white sturgeon.

Table 5C.5.2-66. Number of Years in which Water Temperature Exceedances above the 61°F and 68°F Thresholds Are Within Each Level of Concern, Sacramento River at Hamilton City, March through June

Level of Concern	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
61°F Threshold						
Red	8	8	36	57	31	46
Orange	15	16	21	12	19	11
Yellow	31	28	17	10	19	18
None	28	30	8	3	13	7
68°F Threshold						
Red	0	0	0	0	0	0
Orange	0	0	0	0	0	0
Yellow	0	0	2	3	1	1
None	82	82	80	79	81	81

Table 5C.5.2-67. Differences between EBC and ESO Scenarios in the Number of Years in which Water Temperature Exceedances above the 61°F and 68°F Thresholds Are Within Each Level of Concern, Sacramento River at Hamilton City, March through June

Level of Concern	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
61°F Threshold						
Red	23 (288%)	38 (165%)	38 (475%)	38 (475%)	-5 (-16%)	-11 (-24%)
Orange	4 (27%)	-4 (-100%)	-5 (-31%)	-5 (-31%)	-2 (-11%)	-1 (-9%)
Yellow	-12 (-39%)	-13 (108%)	-10 (-36%)	-10 (-36%)	2 (11%)	8 (44%)
None	-15 (-54%)	-21 (140%)	-23 (-77%)	-23 (-77%)	5 (38%)	4 (57%)
68°F Threshold						
Red	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
Orange	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
Yellow	1 (NA)	1 (100%)	1 (NA)	1 (NA)	-1 (-100%)	-2 (-200%)
None	-1 (-1%)	-1 (100%)	-1 (-1%)	-1 (-1%)	1 (1%)	2 (2%)

Degree-days exceeding 61°F and 68°F at Hamilton City were summed by month and water-year type during March through June and are presented in Table 5C.5.2-68 and Table 5C.5.2-69, respectively. Differences between model scenarios in degree-days exceeding 61°F and 68°F are presented in Table 5C.5.2-70 and Table 5C.5.2-71, respectively. For the 61°F (optimal) threshold, degree-days would generally not differ between EBC2_ELT and ESO_ELT or between BC2_LLT and ESO_LLT during March and April. There would be 268 to 774 (10% to 16%) fewer degree-days above the threshold for all water years combined under ESO_ELT and ESO_LLT than under EBC2_ELT and EBC2_LLT, respectively, during May and June. This would provide a small benefit to white sturgeon optimal spawning and egg incubation in the Sacramento River. For the 68°F (lethal) threshold, there would be no difference in the number of degree-days exceeding the threshold during March and April. During May and June, the number of degree-days for all water years combined would be 30% to 43% lower under EOS_ELT and ESO_LLT relative to EBC2_ELT and EBC2_LLT, although differences on an absolute scale (2 to 20 degree-days) would not likely have biologically meaningful effects on sturgeon due to the small magnitude. Therefore, these results indicate that the ESO would not affect lethal temperature exposure of white sturgeon during spawning and egg incubation in the Sacramento River.

Overall, the results of these temperatures analyses indicate that the ESO would improve optimal (<61°F) white sturgeon spawning and egg incubation temperature conditions in the Sacramento River and would not alter temperature conditions related to lethality of white sturgeon spawners and eggs (<68°F) because lethal temperature would be very rarely exceeded under any model scenario. It should be noted that this calculation only includes days on which water temperatures would exceed thresholds and does not include days when water temperature would be below the threshold.

Table 5C.5.2-68. Total Degree-Days (°F-Days) by Month and Water-Year Type for Water Temperature Exceedances above 61°F in the Sacramento River at Hamilton City, March through June

Month	Water-Year Type	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Mar	W	0	0	0	0	0	0
	AN	0	0	0	0	0	0
	BN	0	0	0	4	2	5
	D	0	0	3	11	3	11
	C	0	0	0	1	0	1
	All	0	0	3	16	5	17
Apr	W	12	13	30	78	30	77
	AN	10	9	25	78	25	69
	BN	6	12	26	68	22	68
	D	51	51	94	195	98	164
	C	1	1	5	15	3	15
	All	80	86	180	434	178	393
	W	333	335	812	1448	811	1323
May	AN	218	220	454	569	341	441
	BN	184	200	453	633	411	564
	D	202	228	516	635	411	449
	C	202	215	428	552	421	570
	All	1139	1198	2663	3837	2395	3347
Jun	W	577	555	1067	1535	1002	1216
	AN	305	284	512	671	456	429
	BN	211	211	458	713	388	575
	D	335	345	665	1037	538	913
	C	374	352	610	920	555	969
	All	1802	1747	3312	4876	2939	4102

Table 5C.5.2-69. Total Degree-Days (°F-Days) by Month and Water-Year Type for Water Temperature Exceedances above 68°F in the Sacramento River at Hamilton City, March through June

Month	Water-Year Type	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Mar	W	0	0	0	0	0	0
	AN	0	0	0	0	0	0
	BN	0	0	0	0	0	0
	D	0	0	0	0	0	0
	C	0	0	0	0	0	0
	All	0	0	0	0	0	0
Apr	W	0	0	0	0	0	0
	AN	0	0	0	0	0	0
	BN	0	0	0	0	0	0
	D	0	0	0	0	0	0
	C	0	0	0	0	0	0
	All	0	0	0	0	0	0

Month	Water-Year Type	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
May	W	7	7	16	43	16	42
	AN	0	0	13	20	3	1
	BN	0	0	0	0	0	1
	D	0	0	0	2	0	0
	C	0	0	1	1	1	2
	All	7	7	30	66	20	46
Jun	W	0	0	2	8	2	7
	AN	1	1	2	5	0	2
	BN	0	0	0	2	0	2
	D	0	0	0	0	0	0
	C	0	0	1	27	1	13
	All	1	1	5	42	3	24

Table 5C.5.2-70. Differences between EBC and ESO Scenarios in Total Degree-Days (°F-Days) by Month and Water-Year Type for Water Temperature Exceedances above 61°F in the Sacramento River at Hamilton City, March through June

Month	Water-Year Type	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Mar	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	2 (NA)	5 (NA)	2 (NA)	5 (NA)	2 (NA)	1 (25%)
	D	3 (NA)	11 (NA)	3 (NA)	11 (NA)	0 (0%)	0 (0%)
	C	0 (NA)	1 (NA)	0 (NA)	1 (NA)	0 (NA)	0 (0%)
	All	5 (NA)	17 (NA)	5 (NA)	17 (NA)	2 (67%)	1 (6%)
Apr	W	18 (150%)	65 (542%)	17 (131%)	64 (492%)	0 (0%)	-1 (-1%)
	AN	15 (150%)	59 (590%)	16 (178%)	60 (667%)	0 (0%)	-9 (-12%)
	BN	16 (267%)	62 (1033%)	10 (83%)	56 (467%)	-4 (-15%)	0 (0%)
	D	47 (92%)	113 (222%)	47 (92%)	113 (222%)	4 (4%)	-31 (-16%)
	C	2 (200%)	14 (1400%)	2 (200%)	14 (1400%)	-2 (-40%)	0 (0%)
	All	98 (123%)	313 (391%)	92 (107%)	307 (357%)	-2 (-1%)	-41 (-9%)
May	W	478 (144%)	990 (297%)	476 (142%)	988 (295%)	-1 (0%)	-125 (-9%)
	AN	123 (56%)	223 (102%)	121 (55%)	221 (100%)	-113 (-25%)	-128 (-22%)
	BN	227 (123%)	380 (207%)	211 (106%)	364 (182%)	-42 (-9%)	-69 (-11%)
	D	209 (103%)	247 (122%)	183 (80%)	221 (97%)	-105 (-20%)	-186 (-29%)
	C	219 (108%)	368 (182%)	206 (96%)	355 (165%)	-7 (-2%)	18 (3%)
	All	1256 (110%)	2208 (194%)	1197 (100%)	2149 (179%)	-268 (-10%)	-490 (-13%)
Jun	W	425 (74%)	639 (111%)	447 (81%)	661 (119%)	-65 (-6%)	-319 (-21%)
	AN	151 (50%)	124 (41%)	172 (61%)	145 (51%)	-56 (-11%)	-242 (-36%)
	BN	177 (84%)	364 (173%)	177 (84%)	364 (173%)	-70 (-15%)	-138 (-19%)
	D	203 (61%)	578 (173%)	193 (56%)	568 (165%)	-127 (-19%)	-124 (-12%)
	C	181 (48%)	595 (159%)	203 (58%)	617 (175%)	-55 (-9%)	49 (5%)
	All	1137 (63%)	2300 (128%)	1192 (68%)	2355 (135%)	-373 (-11%)	-774 (-16%)

Table 5C.5.2-71. Differences between EBC and ESO Scenarios in Total Degree-Days (°F-Days) by Month and Water-Year Type for Water Temperature Exceedances above 68°F in the Sacramento River at Hamilton City, March through June

Month	Water-Year Type	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Mar	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
Apr	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
May	W	9 (129%)	35 (500%)	9 (129%)	35 (500%)	0 (0%)	-1 (-2%)
	AN	3 (NA)	1 (NA)	3 (NA)	1 (NA)	-10 (-77%)	-19 (-95%)
	BN	0 (NA)	1 (NA)	0 (NA)	1 (NA)	0 (NA)	1 (NA)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	-2 (-100%)
	C	1 (NA)	2 (NA)	1 (NA)	2 (NA)	0 (0%)	1 (100%)
	All	13 (186%)	39 (557%)	13 (186%)	39 (557%)	-10 (-33%)	-20 (-30%)
Jun	W	2 (NA)	7 (NA)	2 (NA)	7 (NA)	0 (0%)	-1 (-13%)
	AN	-1 (-100%)	1 (100%)	-1 (-100%)	1 (100%)	-2 (-100%)	-3 (-60%)
	BN	0 (NA)	2 (NA)	0 (NA)	2 (NA)	0 (NA)	0 (0%)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	1 (NA)	13 (NA)	1 (NA)	13 (NA)	0 (0%)	-14 (-52%)
	All	2 (200%)	23 (2300%)	2 (200%)	23 (2300%)	-2 (-40%)	-18 (-43%)

Seasonal Flows

Changes in flows in this reach where sturgeon spawn and their eggs incubate could result in changes to water circulation around developing embryos, turbidity contributing to reduced predation mortality, or larval dispersal and rearing conditions. An analysis of the potential changes in flow was completed for the Sacramento River at Verona and Wilkins Slough within the February through May period of egg/embryo occurrence (Israel et al. 2009). Monthly mean flows for each model scenario by water-year type at Wilkins Slough and Verona are presented in Table 5C.5.2-58 and Table 5C.5.2-72, respectively. Differences between pairs of model scenarios are presented in Table 5C.5.2-59 and Table 5C.5.2-73, respectively. Monthly flow exceedance plots for all months are presented in Figure 5C.5.2-54 through Figure 5C.5.2-65 for Wilkins Slough and in Figure 5C.5.2-66 through Figure 5C.5.2-77 for Verona. Monthly exceedance plots for the February through May white sturgeon spawning and egg incubation period are presented for Wilkins Slough in Figure 5C.5.2-55 through Figure 5C.5.2-58 and for Verona in Figure 5C.5.2-67 through Figure 5C.5.2-70. Flows under the ESO_ELT and ESO_LLT during February through April at Wilkins Slough would generally be similar to flows under EBC2_ELT and EBC2_LLT, respectively. Flows during May would generally be higher under ESO_ELT and ESO_LLT than those under EBC2_ELT and EBC2_LLT by up to 17% depending on water-year type and implementation period. At Verona, flows during February, March, and April under ESO_ELT and ESO_LLT would generally be similar to or up to 8% lower than flows under EBC2_ELT and EBC2_LLT, respectively. Flows under ESO_ELT and ESO_LLT during May would be similar to flows under EBC2_ELT and flows under ESO_LLT would be slightly higher than flows under EBC2_LLT (7% higher on average).

Flows at Wilkins Slough and Verona under LOS would be similar to those under ESO throughout the February through May period (Table 5C.5.2-60, Table 5C.5.2-61, Table 5C.5.2-74, Table 5C.5.2-75). Flows at Wilkins Slough under HOS during February and March would be similar to those under ESO, although flows would be minorly (up to 13%) lower than those under the ESO in some water-year types during April and May. However, these reductions would not cause negative effects on white sturgeon spawning and egg incubation because they are of low magnitude and infrequent. Flows at Verona under HOS would be similar to or greater than those under ESO, due to increased flows from the Feather River to meet spring outflow conditions. These results indicate that flows in the Sacramento River between Wilkins Slough and Verona during the white sturgeon egg incubation period would generally be maintained under the ESO, HOS, and LOS scenarios. There is moderate certainty in this conclusion.

Table 5C.5.2-72. Mean Monthly Flows (cfs) in the Sacramento River at Verona under EBC and ESO Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	44,589	44,222	45,074	45,567	43,368	43,978
	AN	34,120	32,683	32,939	33,671	31,498	31,703
	BN	20,175	19,166	19,324	19,121	17,820	17,594
	D	14,756	14,410	14,643	14,782	14,042	13,967
	C	12,085	12,116	12,331	13,051	11,618	12,837
	All	27,583	27,013	27,430	27,795	26,185	26,532
Feb	W	49,892	49,358	50,745	51,326	49,193	50,214
	AN	39,162	38,278	39,631	39,749	38,675	38,602
	BN	26,429	25,327	25,717	25,341	23,861	24,153
	D	18,402	18,272	18,079	18,090	17,146	17,163
	C	12,822	12,706	12,387	12,325	12,073	11,881
	All	31,979	31,446	32,062	32,192	30,862	31,200
Mar	W	43,455	43,320	44,098	44,624	42,020	42,403
	AN	39,477	38,721	39,691	39,687	37,948	37,875
	BN	21,484	20,234	19,717	19,448	18,292	17,809
	D	17,868	17,665	17,411	17,649	16,398	16,658
	C	11,903	11,767	11,765	11,789	11,745	11,736
	All	28,888	28,456	28,700	28,877	27,318	27,402
Apr	W	32,219	32,298	32,102	31,636	29,808	29,403
	AN	22,250	22,228	21,717	21,313	20,331	20,197
	BN	14,459	14,169	13,834	13,857	13,363	14,249
	D	11,113	11,051	10,967	10,903	11,113	11,498
	C	9,420	9,374	9,304	9,489	9,388	9,555
	All	19,759	19,710	19,488	19,298	18,522	18,634

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
May	W	26,193	26,069	23,714	20,229	23,617	20,855
	AN	17,079	16,918	16,427	16,002	18,037	17,899
	BN	11,451	11,175	10,653	10,534	11,070	12,319
	D	9,283	9,116	9,086	9,841	9,621	10,969
	C	7,125	7,030	7,408	7,611	7,148	7,671
	All	15,840	15,679	14,820	13,828	15,176	14,865
Jun	W	18,367	18,331	15,664	15,304	17,607	18,346
	AN	13,590	13,754	12,877	13,574	16,073	17,972
	BN	11,062	11,101	10,888	11,320	14,747	14,742
	D	10,429	10,681	10,702	10,780	12,174	11,870
	C	8,911	9,132	9,441	9,827	9,315	9,578
	All	13,295	13,401	12,441	12,576	14,488	14,971
Jul	W	16,253	16,417	17,144	17,965	16,859	17,237
	AN	17,488	17,919	18,014	18,338	18,091	18,003
	BN	16,698	16,871	16,823	16,598	16,747	15,348
	D	16,352	16,474	16,245	16,465	14,669	12,407
	C	14,476	13,644	13,348	12,457	10,570	9,749
	All	16,271	16,321	16,464	16,651	15,619	14,871
Aug	W	12,464	12,763	13,393	14,016	12,720	12,540
	AN	13,691	14,088	14,684	15,828	14,626	14,064
	BN	13,389	13,543	13,098	14,074	13,438	12,640
	D	14,688	13,865	13,057	13,018	10,148	10,109
	C	9,207	9,262	8,300	8,085	8,359	7,776
	All	12,813	12,820	12,713	13,204	11,919	11,549
Sep	W	14,279	23,282	22,873	23,592	20,732	22,522
	AN	10,537	17,532	18,667	19,044	15,782	16,665
	BN	9,961	10,138	10,768	10,576	8,819	8,446
	D	10,542	9,828	8,618	7,664	7,884	8,385
	C	7,764	7,552	7,264	6,832	7,287	8,062
	All	11,220	14,941	14,777	14,755	13,186	14,042
Oct	W	11,503	10,891	10,681	11,232	10,829	11,049
	AN	9,381	8,866	8,617	9,890	8,462	10,231
	BN	9,867	9,327	8,868	10,146	8,865	9,468
	D	8,681	8,342	8,515	8,989	8,949	9,138
	C	8,543	7,996	7,862	8,104	7,556	8,534
	All	9,861	9,344	9,181	9,900	9,256	9,872
Nov	W	15,307	16,396	16,176	15,754	15,027	14,453
	AN	11,792	12,842	13,177	12,817	11,449	10,873
	BN	9,852	10,604	10,676	10,437	9,186	9,306
	D	10,157	9,877	10,024	9,731	9,185	8,924
	C	7,341	7,438	7,283	7,223	6,884	6,760
	All	11,565	12,145	12,146	11,846	11,032	10,711

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Dec	W	33,840	31,867	33,224	31,254	31,091	29,513
	AN	17,572	18,022	18,415	18,481	17,617	17,667
	BN	13,099	13,270	13,257	13,028	13,009	12,914
	D	12,685	12,540	12,465	12,532	12,298	12,285
	C	9,770	9,084	8,724	8,627	8,974	9,443
	All	19,752	19,089	19,506	18,852	18,670	18,227

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-73. Differences[a] between EBC and ESO Scenarios in Mean Monthly Flows in the Sacramento River at Verona

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	-1221 (-2.7%)	-611 (-1.4%)	-854 (-1.9%)	-244 (-0.6%)	-1706 (-3.8%)	-1589 (-3.5%)
	AN	-2623 (-7.7%)	-2417 (-7.1%)	-1185 (-3.6%)	-980 (-3%)	-1441 (-4.4%)	-1968 (-5.8%)
	BN	-2355 (-11.7%)	-2582 (-12.8%)	-1346 (-7%)	-1573 (-8.2%)	-1504 (-7.8%)	-1527 (-8%)
	D	-714 (-4.8%)	-789 (-5.3%)	-367 (-2.5%)	-442 (-3.1%)	-601 (-4.1%)	-815 (-5.5%)
	C	-467 (-3.9%)	752 (6.2%)	-498 (-4.1%)	721 (5.9%)	-713 (-5.8%)	-214 (-1.6%)
	All	-1398 (-5.1%)	-1051 (-3.8%)	-828 (-3.1%)	-481 (-1.8%)	-1245 (-4.5%)	-1263 (-4.5%)
Feb	W	-699 (-1.4%)	322 (0.6%)	-165 (-0.3%)	856 (1.7%)	-1552 (-3.1%)	-1112 (-2.2%)
	AN	-487 (-1.2%)	-560 (-1.4%)	397 (1%)	324 (0.8%)	-956 (-2.4%)	-1147 (-2.9%)
	BN	-2568 (-9.7%)	-2276 (-8.6%)	-1466 (-5.8%)	-1174 (-4.6%)	-1857 (-7.2%)	-1188 (-4.7%)
	D	-1256 (-6.8%)	-1239 (-6.7%)	-1125 (-6.2%)	-1109 (-6.1%)	-932 (-5.2%)	-927 (-5.1%)
	C	-749 (-5.8%)	-941 (-7.3%)	-633 (-5%)	-825 (-6.5%)	-315 (-2.5%)	-444 (-3.6%)
	All	-1117 (-3.5%)	-778 (-2.4%)	-584 (-1.9%)	-246 (-0.8%)	-1200 (-3.7%)	-992 (-3.1%)
Mar	W	-1435 (-3.3%)	-1052 (-2.4%)	-1301 (-3%)	-917 (-2.1%)	-2078 (-4.7%)	-2221 (-5%)
	AN	-1530 (-3.9%)	-1603 (-4.1%)	-773 (-2%)	-846 (-2.2%)	-1744 (-4.4%)	-1813 (-4.6%)
	BN	-3192 (-14.9%)	-3675 (-17.1%)	-1942 (-9.6%)	-2425 (-12%)	-1425 (-7.2%)	-1639 (-8.4%)
	D	-1470 (-8.2%)	-1210 (-6.8%)	-1267 (-7.2%)	-1007 (-5.7%)	-1012 (-5.8%)	-991 (-5.6%)
	C	-158 (-1.3%)	-168 (-1.4%)	-22 (-0.2%)	-32 (-0.3%)	-20 (-0.2%)	-54 (-0.5%)
	All	-1570 (-5.4%)	-1486 (-5.1%)	-1139 (-4%)	-1054 (-3.7%)	-1382 (-4.8%)	-1475 (-5.1%)
Apr	W	-2411 (-7.5%)	-2817 (-8.7%)	-2490 (-7.7%)	-2895 (-9%)	-2293 (-7.1%)	-2233 (-7.1%)
	AN	-1919 (-8.6%)	-2053 (-9.2%)	-1896 (-8.5%)	-2031 (-9.1%)	-1386 (-6.4%)	-1116 (-5.2%)
	BN	-1096 (-7.6%)	-210 (-1.5%)	-807 (-5.7%)	79 (0.6%)	-471 (-3.4%)	392 (2.8%)
	D	0 (0%)	385 (3.5%)	62 (0.6%)	447 (4%)	146 (1.3%)	595 (5.5%)
	C	-32 (-0.3%)	135 (1.4%)	15 (0.2%)	182 (1.9%)	84 (0.9%)	66 (0.7%)
	All	-1237 (-6.3%)	-1125 (-5.7%)	-1189 (-6%)	-1077 (-5.5%)	-966 (-5%)	-664 (-3.4%)
May	W	-2576 (-9.8%)	-5338 (-20.4%)	-2452 (-9.4%)	-5214 (-20%)	-96 (-0.4%)	626 (3.1%)
	AN	958 (5.6%)	819 (4.8%)	1120 (6.6%)	981 (5.8%)	1610 (9.8%)	1897 (11.9%)
	BN	-381 (-3.3%)	867 (7.6%)	-105 (-0.9%)	1144 (10.2%)	417 (3.9%)	1784 (16.9%)
	D	337 (3.6%)	1685 (18.2%)	505 (5.5%)	1852 (20.3%)	535 (5.9%)	1127 (11.5%)
	C	23 (0.3%)	546 (7.7%)	118 (1.7%)	641 (9.1%)	-260 (-3.5%)	60 (0.8%)
	All	-664 (-4.2%)	-975 (-6.2%)	-503 (-3.2%)	-814 (-5.2%)	356 (2.4%)	1037 (7.5%)

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jun	W	-760 (-4.1%)	-21 (-0.1%)	-724 (-3.9%)	15 (0.1%)	1943 (12.4%)	3043 (19.9%)
	AN	2483 (18.3%)	4382 (32.2%)	2319 (16.9%)	4218 (30.7%)	3196 (24.8%)	4398 (32.4%)
	BN	3685 (33.3%)	3680 (33.3%)	3646 (32.8%)	3641 (32.8%)	3859 (35.4%)	3422 (30.2%)
	D	1746 (16.7%)	1441 (13.8%)	1494 (14%)	1189 (11.1%)	1472 (13.8%)	1089 (10.1%)
	C	404 (4.5%)	667 (7.5%)	183 (2%)	446 (4.9%)	-126 (-1.3%)	-248 (-2.5%)
	All	1194 (9%)	1677 (12.6%)	1087 (8.1%)	1570 (11.7%)	2047 (16.5%)	2395 (19%)
Jul	W	606 (3.7%)	984 (6.1%)	442 (2.7%)	820 (5%)	-285 (-1.7%)	-728 (-4.1%)
	AN	603 (3.4%)	515 (2.9%)	173 (1%)	84 (0.5%)	77 (0.4%)	-335 (-1.8%)
	BN	50 (0.3%)	-1349 (-8.1%)	-124 (-0.7%)	-1523 (-9%)	-76 (-0.4%)	-1250 (-7.5%)
	D	-1683 (-10.3%)	-3945 (-24.1%)	-1805 (-11%)	-4067 (-24.7%)	-1576 (-9.7%)	-4058 (-24.6%)
	C	-3906 (-27%)	-4726 (-32.7%)	-3075 (-22.5%)	-3895 (-28.5%)	-2778 (-20.8%)	-2708 (-21.7%)
	All	-652 (-4%)	-1401 (-8.6%)	-702 (-4.3%)	-1451 (-8.9%)	-844 (-5.1%)	-1781 (-10.7%)
Aug	W	256 (2.1%)	76 (0.6%)	-43 (-0.3%)	-223 (-1.7%)	-673 (-5%)	-1476 (-10.5%)
	AN	935 (6.8%)	372 (2.7%)	538 (3.8%)	-25 (-0.2%)	-57 (-0.4%)	-1764 (-11.1%)
	BN	49 (0.4%)	-749 (-5.6%)	-105 (-0.8%)	-903 (-6.7%)	340 (2.6%)	-1434 (-10.2%)
	D	-4540 (-30.9%)	-4579 (-31.2%)	-3717 (-26.8%)	-3756 (-27.1%)	-2909 (-22.3%)	-2909 (-22.3%)
	C	-849 (-9.2%)	-1431 (-15.5%)	-904 (-9.8%)	-1486 (-16%)	59 (0.7%)	-309 (-3.8%)
	All	-894 (-7%)	-1264 (-9.9%)	-901 (-7%)	-1270 (-9.9%)	-794 (-6.2%)	-1655 (-12.5%)
Sep	W	6453 (45.2%)	8243 (57.7%)	-2550 (-11%)	-760 (-3.3%)	-2140 (-9.4%)	-1070 (-4.5%)
	AN	5245 (49.8%)	6129 (58.2%)	-1751 (-10%)	-867 (-4.9%)	-2885 (-15.5%)	-2378 (-12.5%)
	BN	-1141 (-11.5%)	-1515 (-15.2%)	-1318 (-13%)	-1692 (-16.7%)	-1949 (-18.1%)	-2130 (-20.1%)
	D	-2658 (-25.2%)	-2156 (-20.5%)	-1944 (-19.8%)	-1442 (-14.7%)	-734 (-8.5%)	722 (9.4%)
	C	-477 (-6.1%)	298 (3.8%)	-264 (-3.5%)	510 (6.8%)	23 (0.3%)	1230 (18%)
	All	1966 (17.5%)	2822 (25.2%)	-1755 (-11.7%)	-899 (-6%)	-1591 (-10.8%)	-712 (-4.8%)
Oct	W	-674 (-5.9%)	-454 (-3.9%)	-61 (-0.6%)	158 (1.5%)	149 (1.4%)	-183 (-1.6%)
	AN	-919 (-9.8%)	850 (9.1%)	-404 (-4.6%)	1365 (15.4%)	-156 (-1.8%)	341 (3.4%)
	BN	-1002 (-10.2%)	-399 (-4%)	-462 (-5%)	141 (1.5%)	-3 (0%)	-678 (-6.7%)
	D	268 (3.1%)	457 (5.3%)	606 (7.3%)	796 (9.5%)	434 (5.1%)	149 (1.7%)
	C	-987 (-11.6%)	-9 (-0.1%)	-440 (-5.5%)	538 (6.7%)	-305 (-3.9%)	431 (5.3%)
	All	-605 (-6.1%)	11 (0.1%)	-89 (-1%)	527 (5.6%)	74 (0.8%)	-28 (-0.3%)
Nov	W	-280 (-1.8%)	-854 (-5.6%)	-1369 (-8.4%)	-1943 (-11.9%)	-1150 (-7.1%)	-1302 (-8.3%)
	AN	-343 (-2.9%)	-919 (-7.8%)	-1393 (-10.8%)	-1969 (-15.3%)	-1728 (-13.1%)	-1944 (-15.2%)
	BN	-666 (-6.8%)	-546 (-5.5%)	-1418 (-13.4%)	-1298 (-12.2%)	-1489 (-13.9%)	-1132 (-10.8%)
	D	-972 (-9.6%)	-1232 (-12.1%)	-692 (-7%)	-952 (-9.6%)	-840 (-8.4%)	-807 (-8.3%)
	C	-457 (-6.2%)	-581 (-7.9%)	-555 (-7.5%)	-678 (-9.1%)	-399 (-5.5%)	-463 (-6.4%)
	All	-533 (-4.6%)	-854 (-7.4%)	-1113 (-9.2%)	-1434 (-11.8%)	-1114 (-9.2%)	-1135 (-9.6%)
Dec	W	-2749 (-8.1%)	-4327 (-12.8%)	-775 (-2.4%)	-2354 (-7.4%)	-2133 (-6.4%)	-1741 (-5.6%)
	AN	45 (0.3%)	95 (0.5%)	-405 (-2.2%)	-355 (-2%)	-798 (-4.3%)	-813 (-4.4%)
	BN	-90 (-0.7%)	-185 (-1.4%)	-261 (-2%)	-356 (-2.7%)	-248 (-1.9%)	-114 (-0.9%)
	D	-387 (-3%)	-400 (-3.2%)	-242 (-1.9%)	-255 (-2%)	-166 (-1.3%)	-247 (-2%)
	C	-796 (-8.2%)	-327 (-3.4%)	-110 (-1.2%)	359 (4%)	250 (2.9%)	816 (9.5%)
	All	-1082 (-5.5%)	-1525 (-7.7%)	-419 (-2.2%)	-862 (-4.5%)	-835 (-4.3%)	-626 (-3.3%)

[a] Negative values reflect lower flows under ESO than under EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

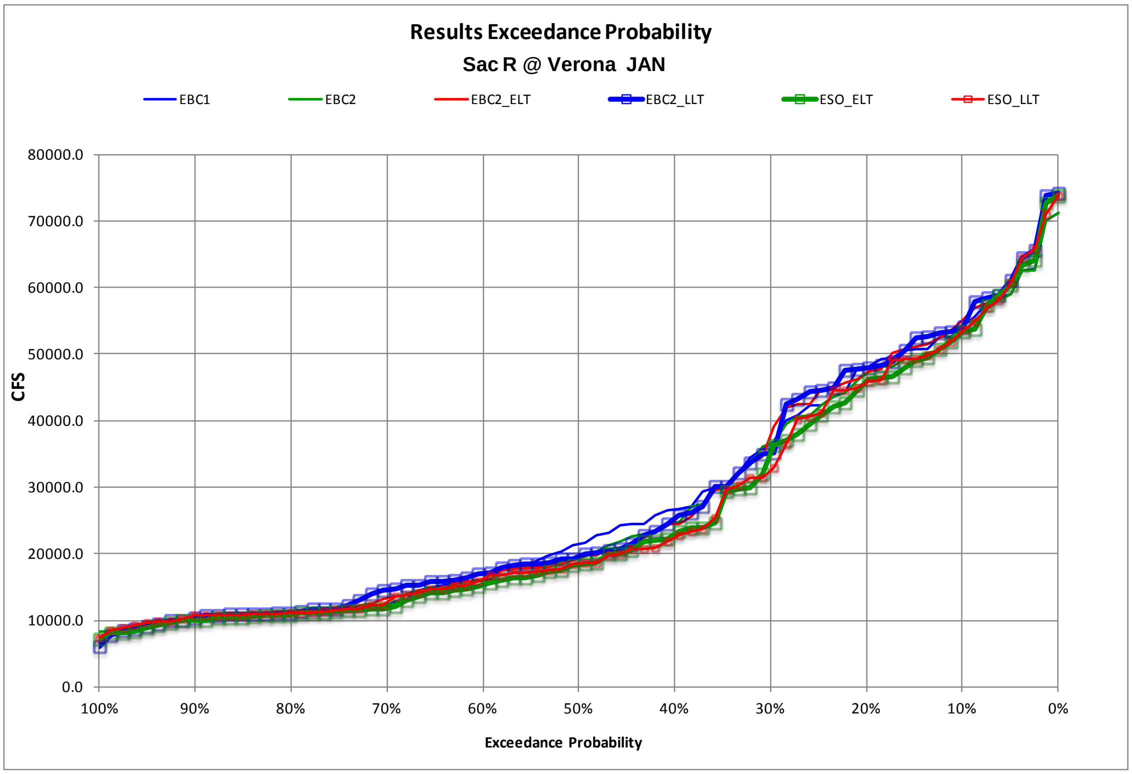


Figure 5C.5.2-66. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Verona, January

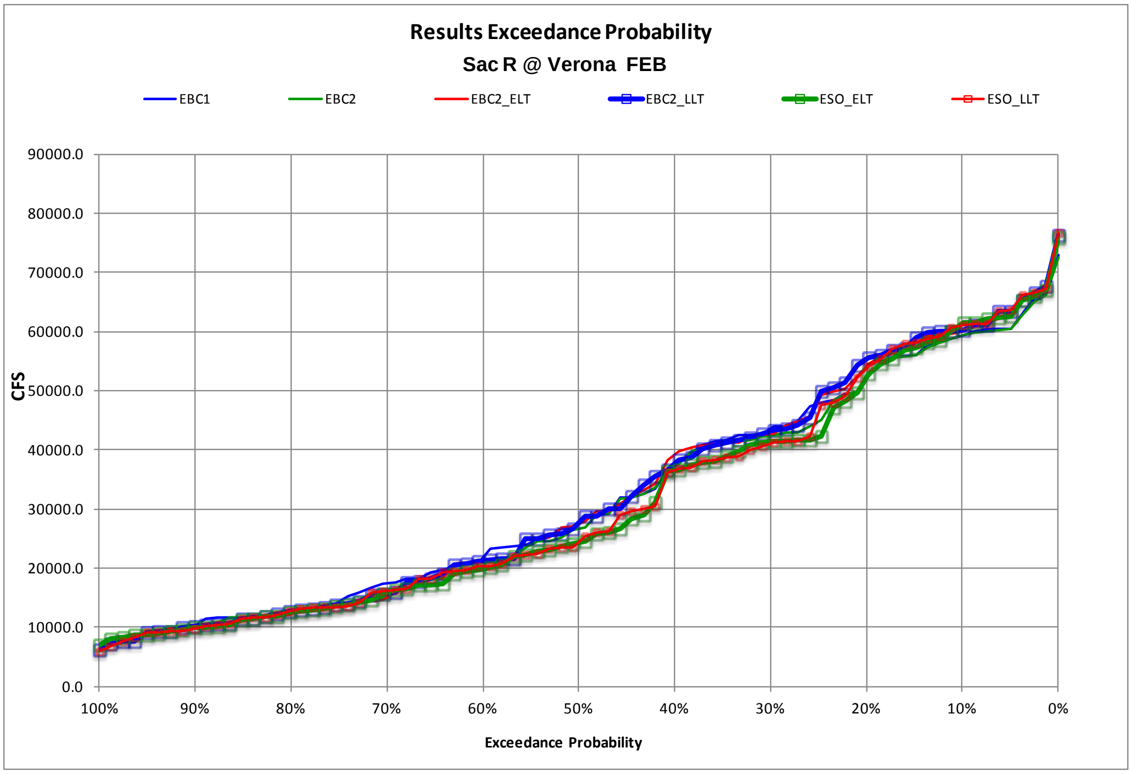


Figure 5C.5.2-67. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Verona, February

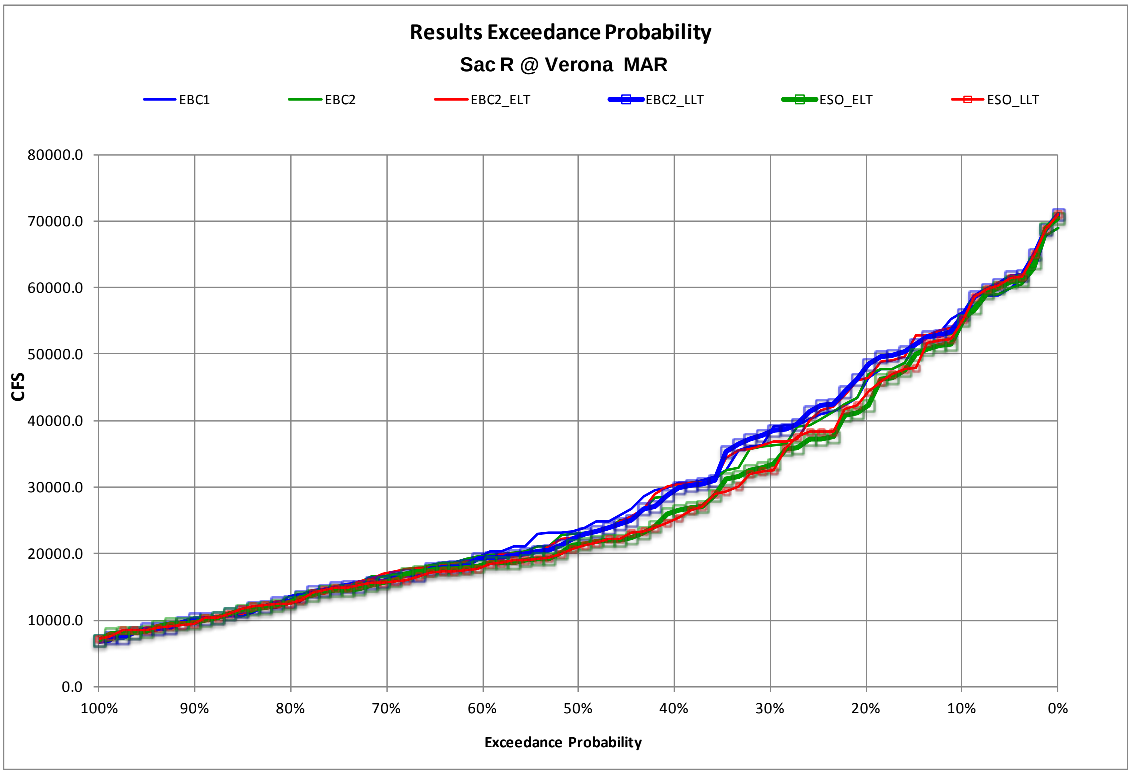


Figure 5C.5.2-68. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Verona, March

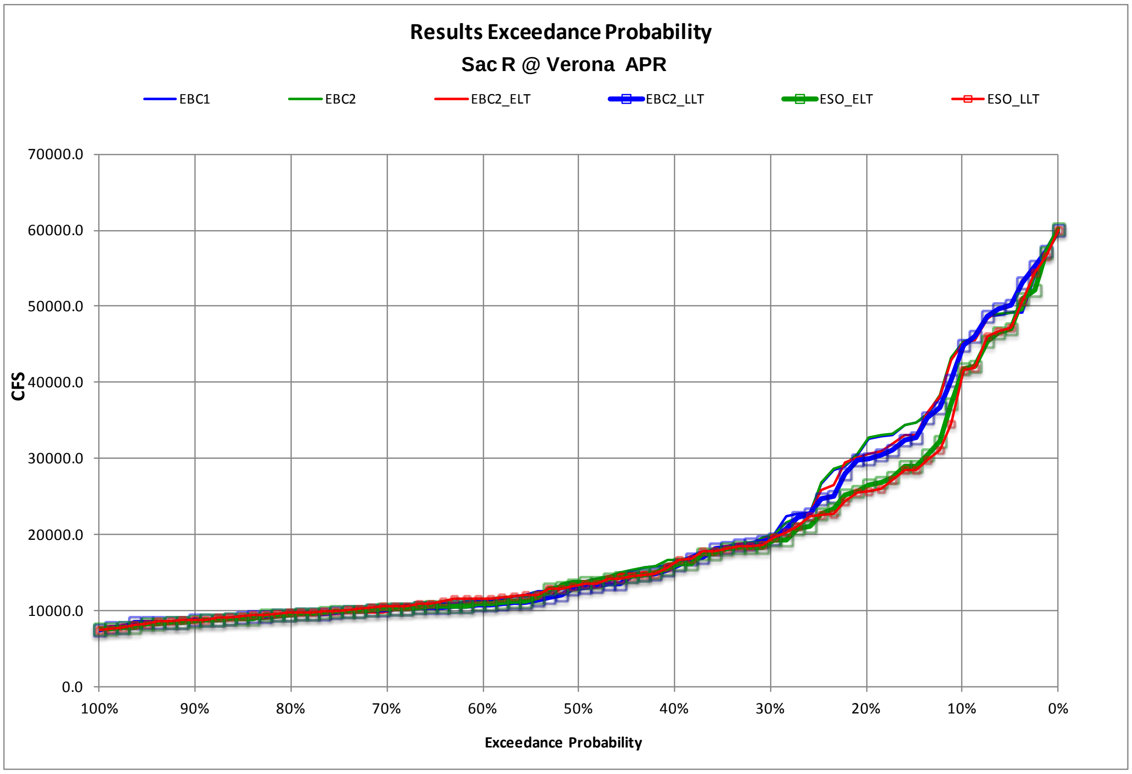


Figure 5C.5.2-69. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Verona, April

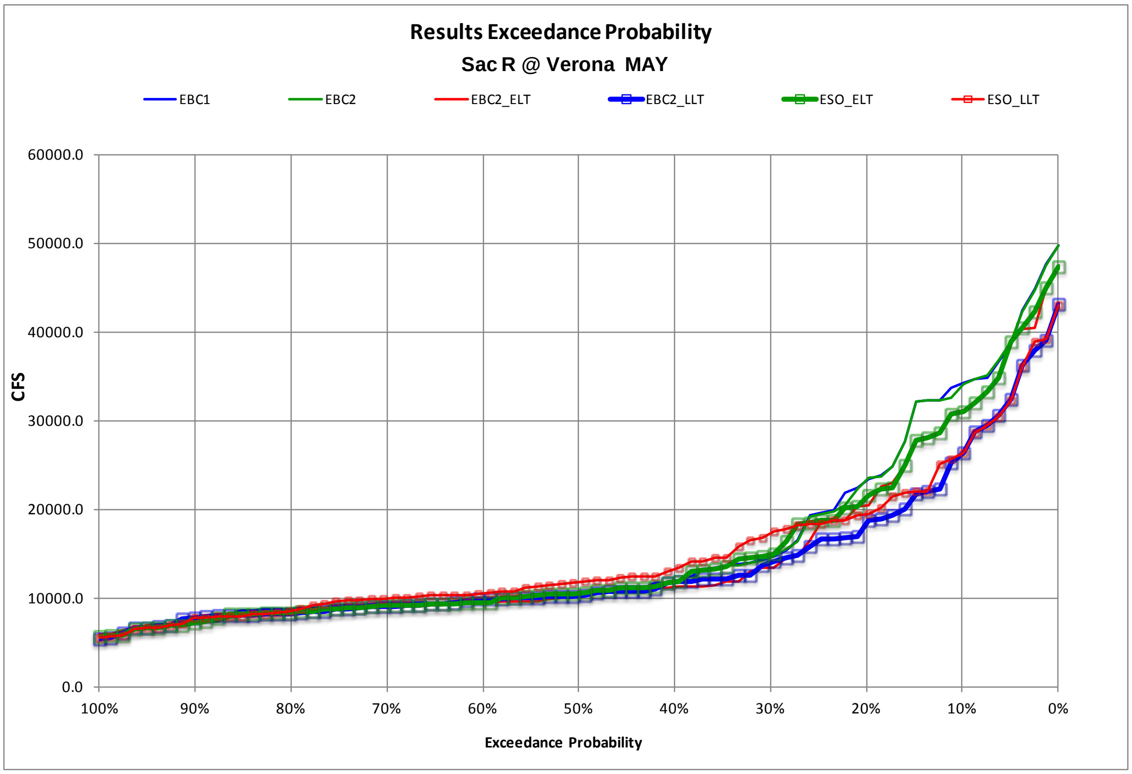


Figure 5C.5.2-70. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Verona, May

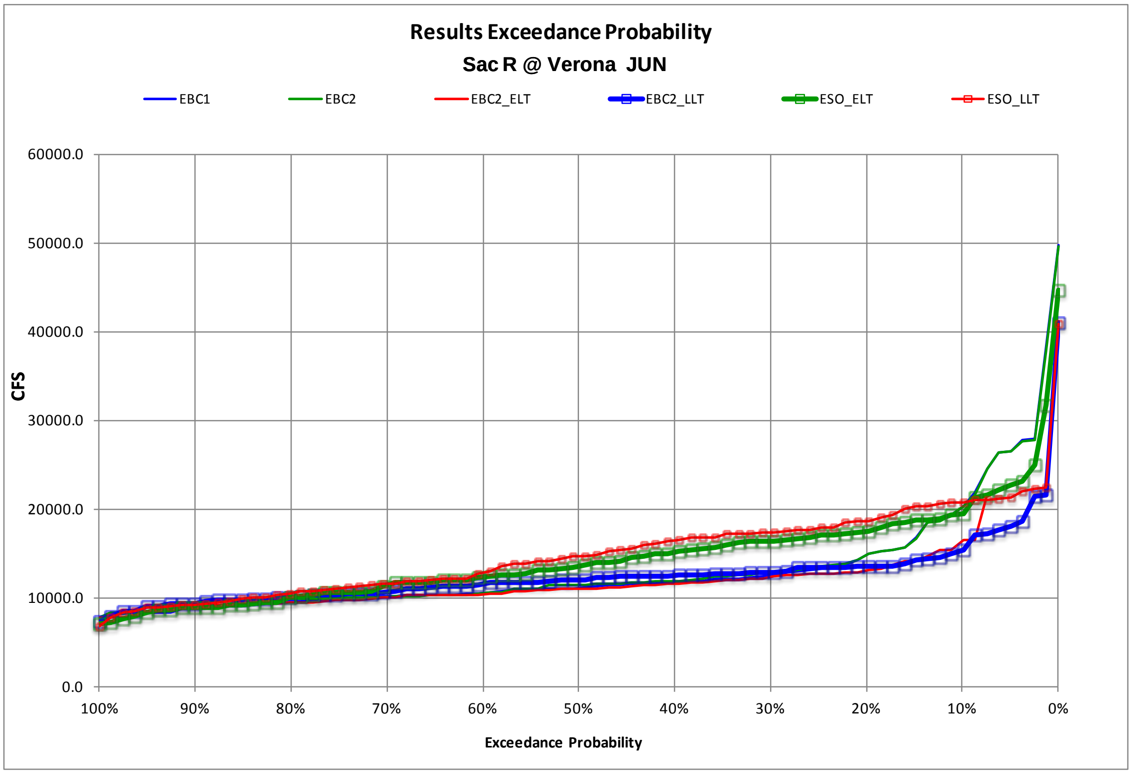


Figure 5C.5.2-71. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Verona, June

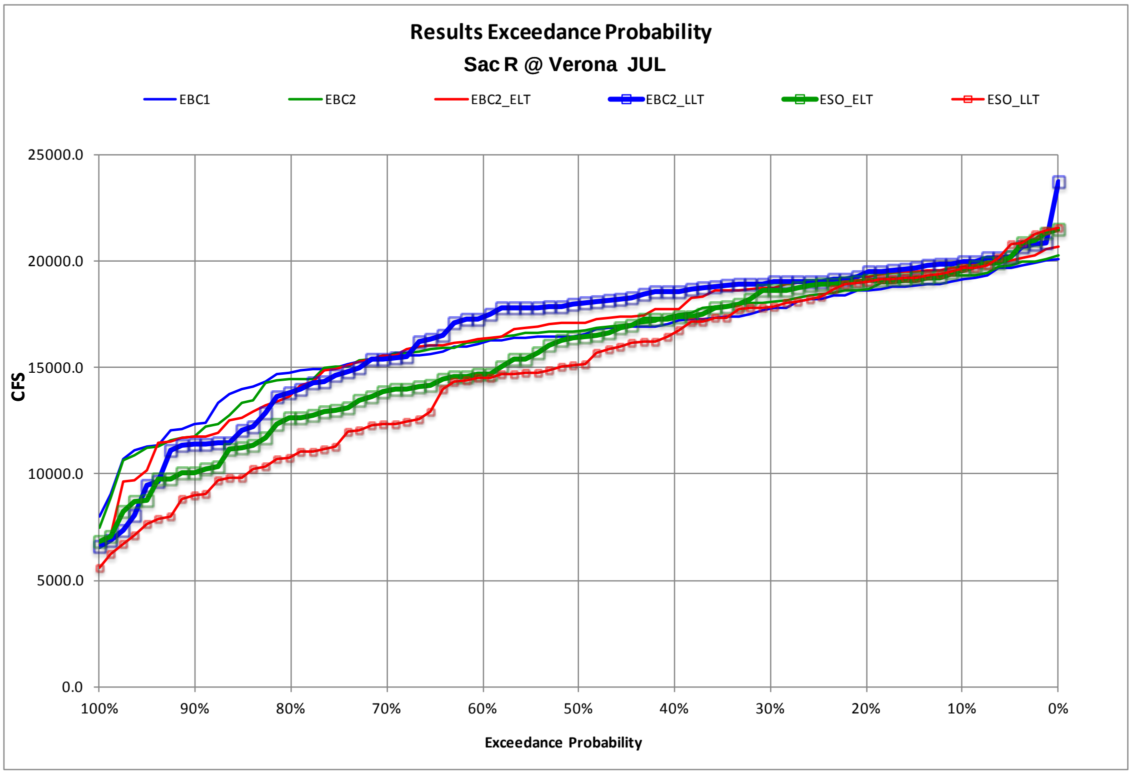


Figure 5C.5.2-72. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Verona, July

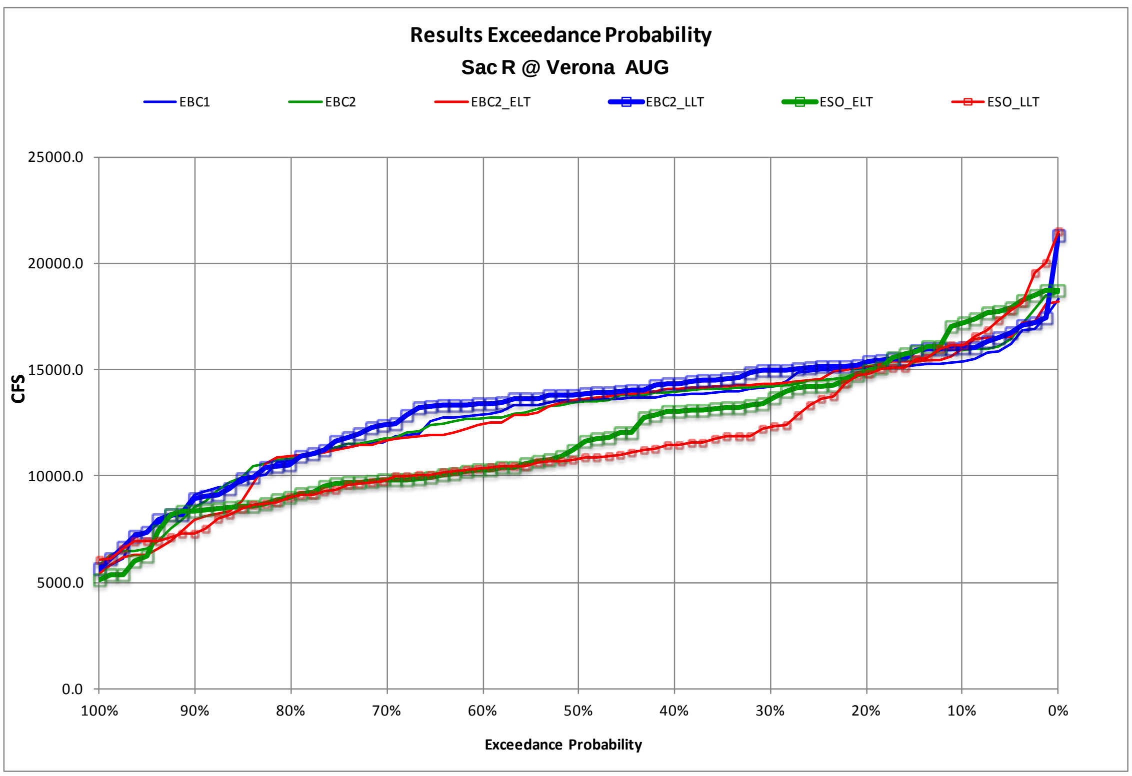


Figure 5C.5.2-73. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Verona, August

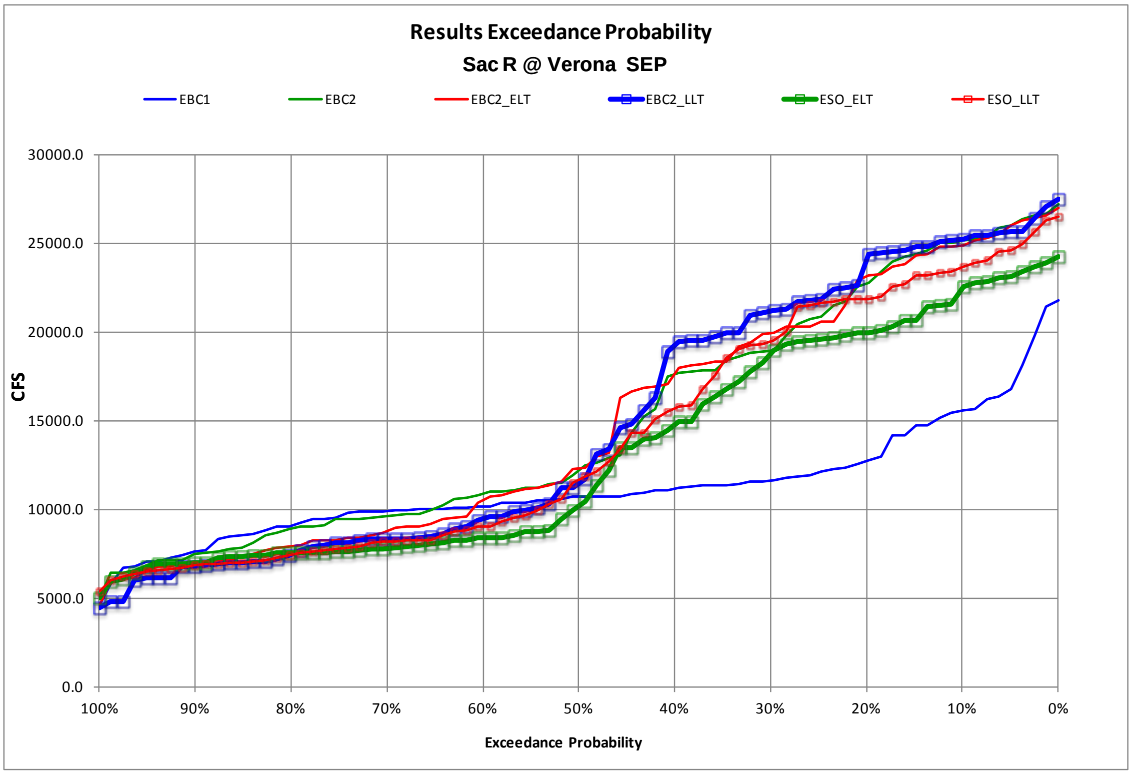


Figure 5C.5.2-74. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Verona, September

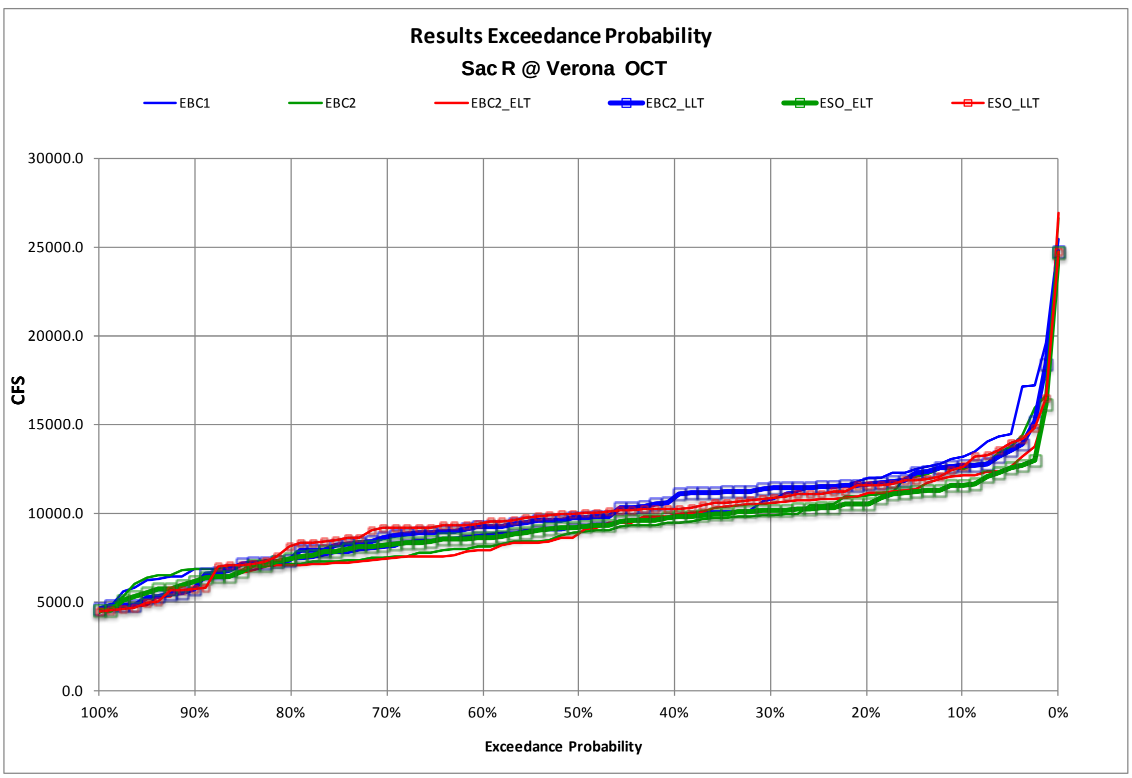


Figure 5C.5.2-75. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Verona, October

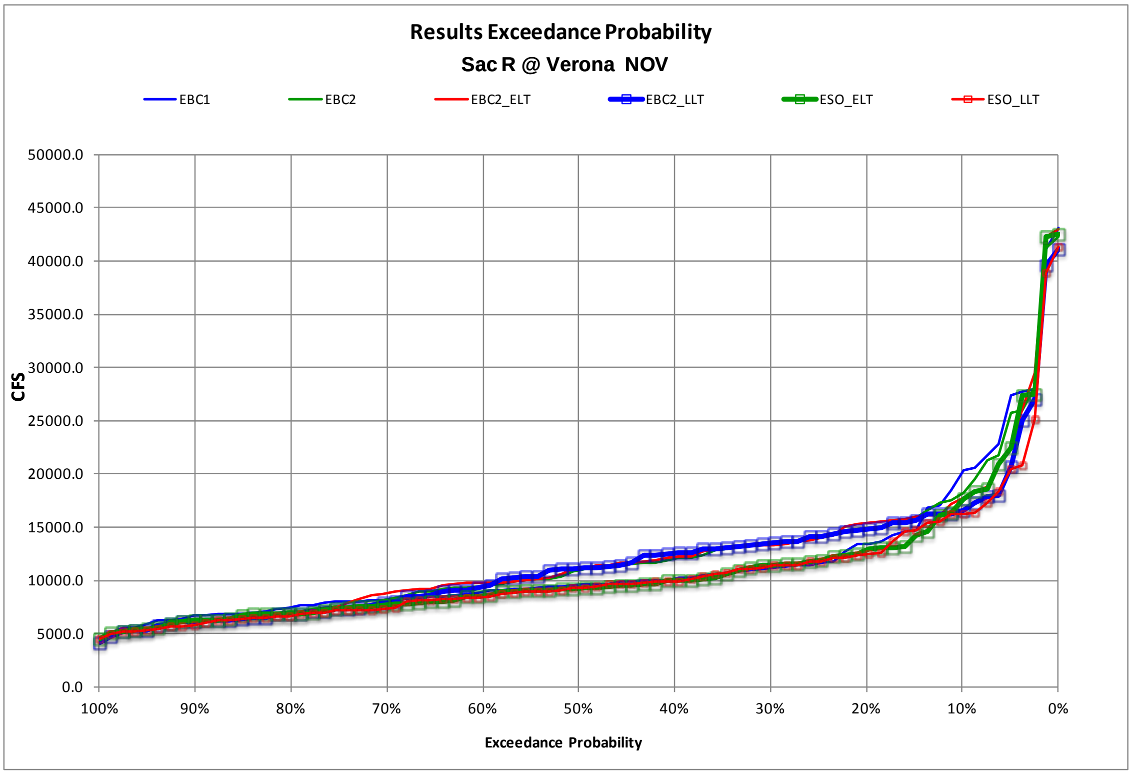


Figure 5C.5.2-76. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Verona, November

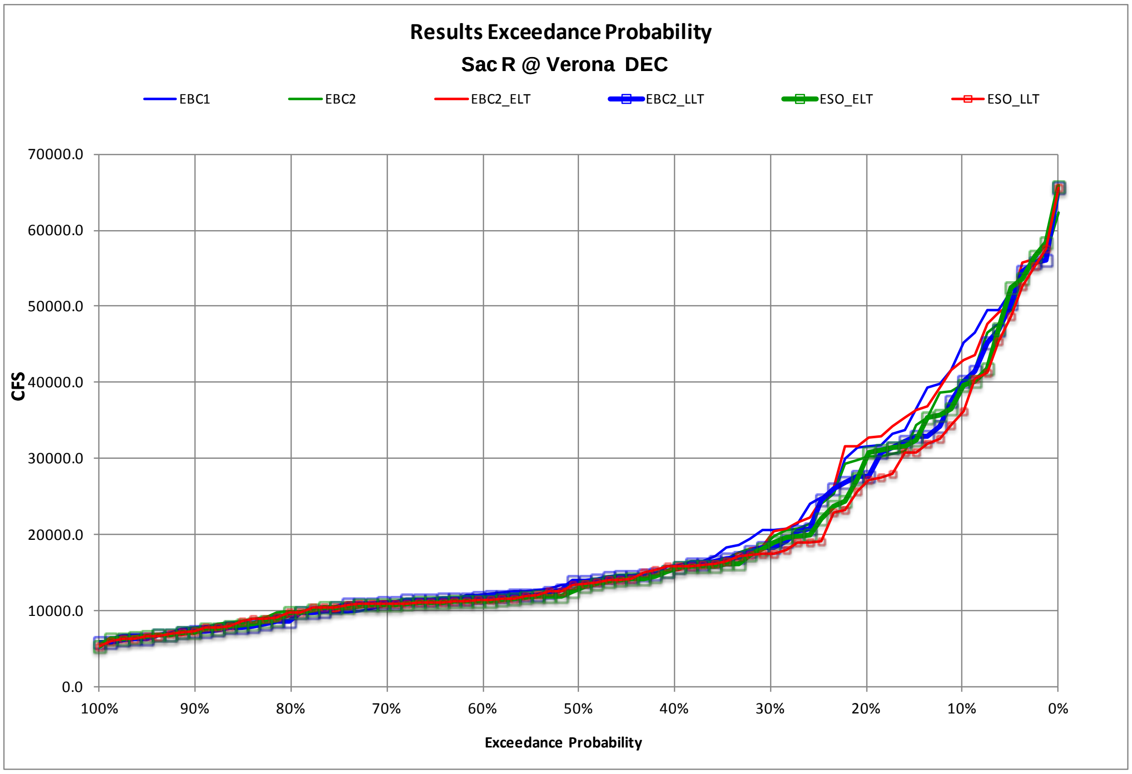


Figure 5C.5.2-77. Probability of Exceedance Plot for Model Scenarios of Mean Monthly Flow in the Sacramento River at Verona, December

Table 5C.5.2-74. Mean Monthly Flows (cfs) in the Sacramento River at Verona for ESO, HOS, and LOS Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	43,368	43,978	43,646	43,717	44,102	44,929
	AN	31,498	31,703	31,734	31,835	32,184	33,229
	BN	17,820	17,594	17,879	17,870	17,981	18,066
	D	14,042	13,967	13,977	13,934	14,258	14,415
	C	11,618	12,837	11,577	11,896	13,242	13,167
	All	26,185	26,532	26,298	26,371	26,831	27,284
Feb	W	49,193	50,214	48,993	49,831	49,232	50,416
	AN	38,675	38,602	38,259	38,766	39,421	39,121
	BN	23,861	24,153	24,512	24,641	24,443	24,855
	D	17,146	17,163	16,991	17,122	17,043	17,167
	C	12,073	11,881	12,003	11,984	11,970	11,896
	All	30,862	31,200	30,804	31,192	31,045	31,463
Mar	W	42,020	42,403	41,973	42,545	42,182	42,607
	AN	37,948	37,875	37,478	36,892	38,234	38,833
	BN	18,292	17,809	18,650	18,151	18,794	18,564
	D	16,398	16,658	16,497	16,715	16,384	16,692
	C	11,745	11,736	11,596	11,686	11,687	11,898
	All	27,318	27,402	27,296	27,367	27,485	27,767
Apr	W	29,808	29,403	32,405	32,143	29,791	29,519
	AN	20,331	20,197	23,299	23,380	20,399	20,270
	BN	13,363	14,249	18,758	18,508	13,796	14,258
	D	11,113	11,498	10,963	11,112	11,091	11,587
	C	9,388	9,555	9,184	9,347	9,457	9,632
	All	18,522	18,634	20,638	20,580	18,605	18,713
May	W	23,617	20,855	26,598	23,431	23,605	20,834
	AN	18,037	17,899	20,607	19,656	17,673	17,645
	BN	11,070	12,319	13,160	12,319	11,394	12,225
	D	9,621	10,969	9,651	10,383	9,657	11,126
	C	7,148	7,671	7,276	7,579	7,453	7,689
	All	15,176	14,865	16,879	15,798	15,227	14,843
Jun	W	17,607	18,346	15,127	15,116	17,619	18,077
	AN	16,073	17,972	13,070	13,789	16,141	17,840
	BN	14,747	14,742	11,940	12,167	15,347	14,813
	D	12,174	11,870	10,717	10,651	12,245	11,905
	C	9,315	9,578	9,024	9,084	9,395	9,294
	All	14,488	14,971	12,421	12,555	14,632	14,845
Jul	W	16,859	17,237	15,269	15,771	16,787	17,038
	AN	18,091	18,003	14,880	14,331	18,002	17,965
	BN	16,747	15,348	14,944	13,926	16,007	15,213
	D	14,669	12,407	13,359	12,237	15,434	13,150
	C	10,570	9,749	10,491	10,240	10,400	9,828
	All	15,619	14,871	14,038	13,660	15,600	14,953

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Aug	W	12,720	12,540	10,801	11,258	12,501	12,412
	AN	14,626	14,064	12,099	12,818	14,539	14,153
	BN	13,438	12,640	12,054	11,623	13,482	12,569
	D	10,148	10,109	10,936	10,722	10,585	10,643
	C	8,359	7,776	9,095	8,487	8,189	8,321
	All	11,919	11,549	10,985	11,026	11,915	11,707
Sep	W	20,732	22,522	20,411	22,255	11,717	10,723
	AN	15,782	16,665	15,179	16,350	11,771	10,709
	BN	8,819	8,446	8,151	8,545	9,518	9,023
	D	7,884	8,385	8,094	8,768	8,681	8,953
	C	7,287	8,062	7,653	8,534	7,347	8,181
	All	13,186	14,042	12,981	14,081	10,044	9,670
Oct	W	10,829	11,049	10,450	10,579	11,034	10,915
	AN	8,462	10,231	8,838	10,963	9,187	10,072
	BN	8,865	9,468	8,972	9,378	9,025	9,749
	D	8,949	9,138	8,284	8,743	8,817	9,450
	C	7,556	8,534	8,147	9,046	8,358	9,336
	All	9,256	9,872	9,149	9,803	9,542	10,040
Nov	W	15,027	14,453	14,880	14,702	14,485	13,942
	AN	11,449	10,873	11,655	11,484	10,685	9,900
	BN	9,186	9,306	9,245	9,142	8,849	8,538
	D	9,185	8,924	8,942	8,866	9,048	8,582
	C	6,884	6,760	6,806	6,798	6,889	6,572
	All	11,032	10,711	10,961	10,844	10,661	10,173
Dec	W	31,091	29,513	31,781	29,982	32,595	31,104
	AN	17,617	17,667	17,789	17,327	17,654	18,057
	BN	13,009	12,914	12,870	12,640	12,878	13,639
	D	12,298	12,285	12,020	11,919	12,593	12,443
	C	8,974	9,443	8,648	8,786	9,333	9,648
	All	18,670	18,227	18,782	18,102	19,247	18,977

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

1 **Table 5C.5.2-75. Differences[a] between ESO Scenarios and HOS and LOS Scenarios in Mean Monthly**
2 **Flows (cfs) in the Sacramento River at Verona**

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	278 (0.6%)	-261 (-0.6%)	734 (1.7%)	951 (2.2%)
	AN	236 (0.7%)	132 (0.4%)	686 (2.2%)	1526 (4.8%)
	BN	58 (0.3%)	277 (1.6%)	161 (0.9%)	472 (2.7%)
	D	-65 (-0.5%)	-33 (-0.2%)	216 (1.5%)	448 (3.2%)
	C	-41 (-0.4%)	-941 (-7.3%)	1623 (14%)	330 (2.6%)
	All	112 (0.4%)	-161 (-0.6%)	646 (2.5%)	752 (2.8%)
Feb	W	-200 (-0.4%)	-383 (-0.8%)	39 (0.1%)	203 (0.4%)
	AN	-416 (-1.1%)	164 (0.4%)	746 (1.9%)	519 (1.3%)
	BN	652 (2.7%)	488 (2%)	582 (2.4%)	702 (2.9%)
	D	-155 (-0.9%)	-41 (-0.2%)	-104 (-0.6%)	4 (0.02%)
	C	-70 (-0.6%)	102 (0.9%)	-103 (-0.9%)	15 (0.1%)
	All	-57 (-0.2%)	-8 (-0.03%)	183 (0.6%)	263 (0.8%)
Mar	W	-46 (-0.1%)	143 (0.3%)	162 (0.4%)	204 (0.5%)
	AN	-469 (-1.2%)	-982 (-2.6%)	286 (0.8%)	958 (2.5%)
	BN	358 (2%)	342 (1.9%)	502 (2.7%)	755 (4.2%)
	D	99 (0.6%)	56 (0.3%)	-14 (-0.1%)	33 (0.2%)
	C	-149 (-1.3%)	-50 (-0.4%)	-58 (-0.5%)	162 (1.4%)
	All	-22 (-0.1%)	-35 (-0.1%)	168 (0.6%)	365 (1.3%)
Apr	W	2597 (8.7%)	2740 (9.3%)	-18 (-0.1%)	116 (0.4%)
	AN	2967 (14.6%)	3183 (15.8%)	68 (0.3%)	73 (0.4%)
	BN	5395 (40.4%)	4259 (29.9%)	434 (3.2%)	9 (0.1%)
	D	-150 (-1.3%)	-386 (-3.4%)	-22 (-0.2%)	89 (0.8%)
	C	-204 (-2.2%)	-208 (-2.2%)	69 (0.7%)	77 (0.8%)
	All	2116 (11.4%)	1947 (10.4%)	84 (0.5%)	80 (0.4%)
May	W	2981 (12.6%)	2577 (12.4%)	-12 (-0.1%)	-21 (-0.1%)
	AN	2569 (14.2%)	1757 (9.8%)	-364 (-2%)	-254 (-1.4%)
	BN	2090 (18.9%)	0 (0%)	324 (2.9%)	-94 (-0.8%)
	D	30 (0.3%)	-586 (-5.3%)	36 (0.4%)	157 (1.4%)
	C	129 (1.8%)	-91 (-1.2%)	305 (4.3%)	18 (0.2%)
	All	1703 (11.2%)	932 (6.3%)	51 (0.3%)	-23 (-0.2%)
Jun	W	-2480 (-14.1%)	-3230 (-17.6%)	12 (0.1%)	-269 (-1.5%)
	AN	-3003 (-18.7%)	-4183 (-23.3%)	68 (0.4%)	-132 (-0.7%)
	BN	-2807 (-19%)	-2575 (-17.5%)	601 (4.1%)	71 (0.5%)
	D	-1457 (-12%)	-1219 (-10.3%)	71 (0.6%)	35 (0.3%)
	C	-291 (-3.1%)	-495 (-5.2%)	80 (0.9%)	-285 (-3%)
	All	-2067 (-14.3%)	-2416 (-16.1%)	144 (1%)	-126 (-0.8%)
Jul	W	-1590 (-9.4%)	-1466 (-8.5%)	-72 (-0.4%)	-199 (-1.2%)
	AN	-3211 (-17.8%)	-3672 (-20.4%)	-90 (-0.5%)	-38 (-0.2%)
	BN	-1804 (-10.8%)	-1422 (-9.3%)	-740 (-4.4%)	-135 (-0.9%)
	D	-1310 (-8.9%)	-170 (-1.4%)	765 (5.2%)	743 (6%)
	C	-79 (-0.7%)	491 (5%)	-169 (-1.6%)	79 (0.8%)
	All	-1581 (-10.1%)	-1210 (-8.1%)	-19 (-0.1%)	83 (0.6%)

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	-1919 (-15.1%)	-1282 (-10.2%)	-219 (-1.7%)	-128 (-1%)
	AN	-2527 (-17.3%)	-1245 (-8.9%)	-87 (-0.6%)	89 (0.6%)
	BN	-1384 (-10.3%)	-1017 (-8%)	44 (0.3%)	-71 (-0.6%)
	D	789 (7.8%)	613 (6.1%)	437 (4.3%)	534 (5.3%)
	C	737 (8.8%)	711 (9.1%)	-170 (-2%)	544 (7%)
	All	-934 (-7.8%)	-524 (-4.5%)	-4 (-0.03%)	157 (1.4%)
Sep	W	-322 (-1.6%)	-267 (-1.2%)	-9015 (-43.5%)	-11799 (-52.4%)
	AN	-603 (-3.8%)	-315 (-1.9%)	-4011 (-25.4%)	-5956 (-35.7%)
	BN	-669 (-7.6%)	99 (1.2%)	698 (7.9%)	577 (6.8%)
	D	210 (2.7%)	382 (4.6%)	796 (10.1%)	568 (6.8%)
	C	366 (5%)	472 (5.9%)	60 (0.8%)	119 (1.5%)
	All	-205 (-1.6%)	39 (0.3%)	-3143 (-23.8%)	-4372 (-31.1%)
Oct	W	-380 (-3.5%)	-470 (-4.3%)	204 (1.9%)	-134 (-1.2%)
	AN	376 (4.4%)	732 (7.2%)	725 (8.6%)	-159 (-1.6%)
	BN	107 (1.2%)	-90 (-1%)	160 (1.8%)	281 (3%)
	D	-665 (-7.4%)	-395 (-4.3%)	-132 (-1.5%)	312 (3.4%)
	C	591 (7.8%)	512 (6%)	802 (10.6%)	802 (9.4%)
	All	-107 (-1.2%)	-69 (-0.7%)	287 (3.1%)	168 (1.7%)
Nov	W	-147 (-1%)	249 (1.7%)	-542 (-3.6%)	-510 (-3.5%)
	AN	206 (1.8%)	611 (5.6%)	-764 (-6.7%)	-973 (-8.9%)
	BN	58 (0.6%)	-164 (-1.8%)	-337 (-3.7%)	-767 (-8.2%)
	D	-242 (-2.6%)	-59 (-0.7%)	-136 (-1.5%)	-343 (-3.8%)
	C	-77 (-1.1%)	38 (0.6%)	5 (0.1%)	-188 (-2.8%)
	All	-71 (-0.6%)	133 (1.2%)	-370 (-3.4%)	-538 (-5%)
Dec	W	690 (2.2%)	469 (1.6%)	1503 (4.8%)	1591 (5.4%)
	AN	172 (1%)	-340 (-1.9%)	37 (0.2%)	390 (2.2%)
	BN	-140 (-1.1%)	-274 (-2.1%)	-131 (-1%)	725 (5.6%)
	D	-278 (-2.3%)	-366 (-3%)	295 (2.4%)	158 (1.3%)
	C	-326 (-3.6%)	-657 (-7%)	359 (4%)	205 (2.2%)
	All	111 (0.6%)	-125 (-0.7%)	577 (3.1%)	750 (4.1%)

[a] Positive values indicate greater monthly flows under HOS or LOS than under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

5C.5.2.1.6.2 Larvae

Water Temperature

Hamilton City was selected as a surrogate for white sturgeon larval rearing habitat located further downstream because no SRWQM nodes are available further downstream where white sturgeon are expected to rear. As reported above, there are no differences in February through June water temperatures between the EBC2 scenario and ESO, HOS, or LOS scenarios in the Sacramento River at Hamilton City regardless of implementation period, month, or water-year type (Table 5C.5.2-62, Table 5C.5.2-63). Therefore, no further temperature-related biological analyses in the Sacramento River on white sturgeon larval rearing are provided.

5C.5.2.1.6.3 Juvenile

Water Temperature

Hamilton City was selected as a surrogate for white sturgeon juvenile rearing habitat located further downstream because no SRWQM nodes are available further downstream where white sturgeon are expected to rear. As reported above, there are no differences in year-round water temperatures between the EBC2 scenario and ESO, HOS, and LOS scenarios in the Sacramento River at Hamilton City regardless of implementation period, month, or water-year type (Table 5C.5.2-62, Table 5C.5.2-63). Therefore, no further temperature-related biological analyses in the Sacramento River on white sturgeon juvenile rearing are provided.

5C.5.2.1.6.4 Adult

Water Temperature

White sturgeon spawning occurs from February through May (Kohlhorst 1976); however, pre-spawn and post-spawn adults occur near spawning areas from winter through late spring, so physical modeling results for January through May were evaluated. To assess the potential for water temperature-related effects of the ESO on white sturgeon spawning habitat, predicted mean monthly temperatures were reviewed for January through May in the Sacramento River at Hamilton City. Predicted mean monthly water temperatures by water-year type at Hamilton City are presented in Table 5C.5.2-62 and differences between pairs of model scenarios are presented in Table 5C.5.2-63. These results indicate that there would be negligible differences between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT in mean water temperatures regardless of month and water-year type in the Sacramento River at Hamilton City during January through May. Similarly, there would be no increases in water temperatures at Hamilton City from ESO to HOS or LOS scenarios during the January through May upstream spawning period (Table 5C.5.2-64, Table 5C.5.2-65). Therefore, no further temperature-related biological analyses in the Sacramento River on white sturgeon spawning are provided.

Spawning Habitat

Gard (1996) developed a suitability index for Sacramento River white sturgeon spawning habitat. This index identified waters with velocities of 3.9–19.95 feet per second (ft/s) as suitable, with velocities of 5–12.5 ft/s as ideal. Further, water depths greater than 6 feet were identified as suitable, while those greater than 10 feet were ideal. In addition, whereas habitats with snags and gravel were considered suitable, those that included cobble, boulder, and bedrock were ideal. These criteria, combined with water temperature upper thresholds, help identify preferential spawning habitats. Although 68°F was investigated as an upper threshold for white sturgeon eggs and embryos, other criteria indicate that temperatures as low as 64°F could also be important for adult white sturgeon spawning habitat. Regardless, as reported above, there are no differences in water temperatures between the ESO and EBC2 in the Sacramento River at Hamilton City regardless of implementation period, month, or water-year type (Table 5C.5.2-62, Table 5C.5.2-63). Similarly, there would be no increases in water temperatures at Hamilton City from ESO to HOS or LOS scenarios during the January through May upstream spawning period (Table 5C.5.2-64, Table 5C.5.2-65). Therefore, no further temperature-related biological analyses in the Sacramento River on white sturgeon spawning and egg incubation are provided.

Due to river channel confinement in the Sacramento drainage, the upstream supply of sediment and large woody debris is limited. Consequently, the absence of large woody debris reduces in-water refuge for fish, and sediment and organic matter accumulation on the downstream side of the debris (U.S. Fish and Wildlife Service 2000) increases depth, water velocities, and substrate grain size. Due to a lack of differences in flow rates at Wilkins Slough during January through May between EBC2, ESO, HOS, and LOS scenarios, (Table 5C.5.2-58, Table 5C.5.2-59) it was concluded with moderate certainty that there would be no differences in depth, velocity, or substrate as factors influencing white sturgeon spawning habitat anticipated between EBC2, ESO, HOS, and LOS scenarios.

5C.5.2.1.7 Green Sturgeon

5C.5.2.1.7.1 Egg/Embryo

Water Temperature

Green sturgeon spawn in the Sacramento River primarily upstream of RBDD during March through July, although spawning can occur above and below RBDD (Adams et al. 2007; Brown 2007; Israel and Klimley 2008; Heublein et al. 2009; Mora et al. 2009; Poytress et al. 2009; Fed Register CRHB). The suitable temperature range for green sturgeon eggs and embryos is 52°F–73°F (11°C–23°C), with optimal temperatures occurring below 63°F (17°C) (Israel and Klimley 2008). Predicted average water temperatures by month and water-year type for the Sacramento River at Keswick and Jelly's Ferry, representative sites in the upper Sacramento River, are presented in Table 5C.5.2-15 and Table 5C.5.2-76, respectively, and differences between model scenarios are presented in Table 5C.5.2-17 and Table 5C.5.2-77 respectively. These results indicate that there would be very small (<2%) differences in water temperature in the Sacramento River at Keswick or Jelly's Ferry in all months and water-year types between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. Differences in water temperatures at Keswick and Jelly's Ferry between the ESO scenario and HOS and LOS scenarios would be minimal throughout the green sturgeon spawning period scenarios (Table 5C.5.2-19, Table 5C.5.2-21, Table 5C.5.2-78, Table 5C.5.2-79).

Table 5C.5.2-76. Mean Monthly Water Temperature (°F) in the Sacramento River at Jelly's Ferry under EBC and ESO Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	45	45	46	47	46	47
	AN	45	45	46	47	46	47
	BN	45	45	46	46	46	46
	D	45	45	46	47	46	47
	C	45	45	46	47	46	47
	All	45	45	46	47	46	47
Feb	W	46	46	47	47	47	47
	AN	46	46	47	48	47	48
	BN	46	46	47	48	47	47
	D	46	46	47	48	47	48
	C	47	47	48	49	48	49
	All	46	46	47	48	47	48
Mar	W	48	48	49	49	49	49
	AN	49	49	50	51	50	51
	BN	49	49	50	51	50	51
	D	50	50	51	51	51	51
	C	50	50	51	52	51	52
	All	49	49	50	51	50	51
Apr	W	51	51	52	53	52	53
	AN	53	53	54	55	54	55
	BN	53	53	54	54	54	54
	D	52	53	53	54	53	54
	C	52	52	53	54	53	54
	All	52	52	53	54	53	54
May	W	54	54	56	57	56	57
	AN	55	55	56	57	56	56
	BN	54	55	56	57	56	56
	D	54	54	55	56	55	55
	C	55	55	56	57	56	57
	All	54	54	56	57	56	56
Jun	W	55	55	56	56	56	56
	AN	55	54	55	56	55	55
	BN	54	54	55	56	55	56
	D	54	55	55	56	55	56
	C	56	56	57	58	57	58
	All	55	55	56	56	56	56
Jul	W	56	56	56	57	56	57
	AN	55	54	55	56	55	56
	BN	55	55	55	56	55	57
	D	55	55	56	57	56	58
	C	57	58	60	62	60	62
	All	55	55	56	57	56	58

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Aug	W	56	56	57	59	57	59
	AN	56	56	57	58	57	59
	BN	56	56	57	58	57	59
	D	56	56	58	59	58	60
	C	59	60	63	67	63	67
	All	57	57	58	60	58	60
Sep	W	56	55	56	57	56	58
	AN	57	56	57	59	58	59
	BN	57	57	58	60	59	61
	D	58	58	60	63	60	62
	C	61	61	64	67	64	67
	All	58	57	59	61	59	61
Oct	W	54	55	56	57	56	57
	AN	54	55	56	57	56	57
	BN	55	55	56	57	56	58
	D	55	55	57	58	57	59
	C	56	56	58	60	58	60
	All	55	55	56	58	56	58
Nov	W	51	51	52	53	52	53
	AN	51	51	52	53	52	53
	BN	51	51	52	54	52	53
	D	51	51	52	54	52	54
	C	52	52	53	55	53	54
	All	51	51	52	53	52	53
Dec	W	47	47	47	48	47	48
	AN	47	47	47	48	47	48
	BN	47	47	48	49	48	49
	D	47	47	48	49	47	49
	C	47	47	48	49	48	49
	All	47	47	48	48	47	48

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-77. Differencesa between EBC and ESO Scenarios in Mean Monthly Water Temperature (°F) in the Sacramento River at Jelly's Ferry

Month	Water-Year Type[b]	Scenario[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	1 (1.4%)	1 (3.2%)	1 (1.6%)	1 (3.3%)	0.03 (0.1%)	0 (0%)
	AN	1 (1.5%)	2 (3.4%)	1 (1.6%)	2 (3.5%)	0 (0%)	0 (0%)
	BN	1 (1.8%)	2 (3.8%)	1 (1.9%)	2 (3.9%)	0.04 (0.1%)	0 (0%)
	D	1 (1.8%)	2 (4%)	1 (1.9%)	2 (4.1%)	0 (0%)	-0.05 (-0.1%)
	C	1 (2.1%)	2 (4.7%)	1 (2%)	2 (4.7%)	-0.1 (-0.1%)	-0.04 (-0.1%)
	All	1 (1.7%)	2 (3.7%)	1 (1.8%)	2 (3.8%)	0 (0%)	0 (0%)
Feb	W	1 (1.8%)	2 (3.4%)	1 (1.8%)	2 (3.4%)	0 (0%)	0 (0%)
	AN	1 (1.7%)	2 (3.5%)	1 (1.8%)	2 (3.5%)	0.04 (0.1%)	0 (0%)
	BN	1 (1.9%)	2 (3.6%)	1 (1.9%)	2 (3.6%)	0 (0%)	0 (0%)
	D	1 (2.1%)	2 (3.9%)	1 (2.1%)	2 (3.9%)	0 (0%)	-0.04 (-0.1%)
	C	1 (2.2%)	2 (4.1%)	1 (2.2%)	2 (4.1%)	0 (0%)	-0.05 (-0.1%)
	All	1 (1.9%)	2 (3.7%)	1 (1.9%)	2 (3.7%)	0 (0%)	0 (0%)
Mar	W	1 (1.4%)	1 (3%)	1 (1.4%)	1 (3.1%)	0 (0%)	0 (0%)
	AN	1 (1.4%)	2 (3.2%)	1 (1.4%)	2 (3.1%)	0 (0%)	0.03 (0.1%)
	BN	1 (1.6%)	2 (3.5%)	1 (1.6%)	2 (3.5%)	0 (0%)	0.05 (0.1%)
	D	1 (1.5%)	2 (3.3%)	1 (1.6%)	2 (3.3%)	0 (0%)	-0.04 (-0.1%)
	C	1 (1.4%)	2 (3.2%)	1 (1.5%)	2 (3.3%)	-0.04 (-0.1%)	-0.2 (-0.4%)
	All	1 (1.5%)	2 (3.2%)	1 (1.5%)	2 (3.2%)	0 (0%)	-0.03 (-0.1%)
Apr	W	1 (1.6%)	2 (3.5%)	1 (1.6%)	2 (3.4%)	0 (0%)	0 (0%)
	AN	1 (1.5%)	2 (3.4%)	1 (1.5%)	2 (3.4%)	0 (0%)	-0.1 (-0.2%)
	BN	1 (1.8%)	2 (3.2%)	1 (1.5%)	2 (2.9%)	0 (0%)	-0.1 (-0.2%)
	D	1 (1.5%)	2 (3.1%)	1 (1.3%)	2 (2.9%)	-0.05 (-0.1%)	-0.2 (-0.4%)
	C	1 (1.8%)	2 (3.8%)	1 (1.5%)	2 (3.5%)	0 (0%)	-0.05 (-0.1%)
	All	1 (1.7%)	2 (3.4%)	1 (1.5%)	2 (3.2%)	0 (0%)	-0.1 (-0.1%)
May	W	2 (3%)	3 (4.9%)	2 (2.9%)	3 (4.8%)	0 (0%)	-0.3 (-0.5%)
	AN	1 (1.4%)	1 (2.1%)	1 (1.3%)	1 (2.1%)	-0.5 (-0.8%)	-1 (-0.9%)
	BN	1 (2.4%)	2 (3.3%)	1 (2.1%)	2 (3%)	-0.2 (-0.3%)	-0.3 (-0.6%)
	D	1 (1.9%)	1 (2.5%)	1 (1.7%)	1 (2.3%)	-0.3 (-0.5%)	-0.5 (-0.8%)
	C	1 (1.9%)	2 (3.7%)	1 (1.7%)	2 (3.5%)	0 (0%)	0.1 (0.2%)
	All	1 (2.3%)	2 (3.5%)	1 (2.1%)	2 (3.3%)	-0.2 (-0.3%)	-0.3 (-0.5%)
Jun	W	1 (1.4%)	1 (1.8%)	1 (1.4%)	1 (1.8%)	-0.1 (-0.2%)	-0.4 (-0.7%)
	AN	1 (1.1%)	1 (1.2%)	1 (1.3%)	1 (1.4%)	-0.2 (-0.3%)	-1 (-1.2%)
	BN	1 (1.2%)	1 (2.3%)	1 (1.2%)	1 (2.3%)	-0.2 (-0.3%)	-0.3 (-0.6%)
	D	1 (1.5%)	2 (3.3%)	1 (1.3%)	2 (3.1%)	-0.2 (-0.4%)	-0.1 (-0.2%)
	C	1 (1.4%)	2 (4%)	1 (1.5%)	2 (4%)	-0.2 (-0.4%)	0.2 (0.4%)
	All	1 (1.3%)	1 (2.4%)	1 (1.3%)	1 (2.4%)	-0.2 (-0.3%)	-0.3 (-0.5%)
Jul	W	0 (0.6%)	1 (1.9%)	0 (0.7%)	1 (2%)	-0.1 (-0.1%)	0.1 (0.2%)
	AN	1 (1.3%)	2 (3.1%)	1 (1.5%)	2 (3.2%)	0.1 (0.2%)	0.3 (0.5%)
	BN	1 (1.2%)	2 (3.6%)	1 (1.1%)	2 (3.6%)	-0.1 (-0.2%)	0.3 (0.6%)
	D	1 (2.1%)	3 (5.7%)	1 (1.9%)	3 (5.5%)	0.1 (0.3%)	1 (1.3%)
	C	2 (3.8%)	5 (8.7%)	2 (3%)	5 (7.9%)	-0.1 (-0.2%)	0 (-0.1%)
	All	1 (1.6%)	2 (4.2%)	1 (1.5%)	2 (4.1%)	0 (0%)	0.3 (0.5%)

Month	Water-Year Type[b]	Scenario[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Aug	W	1 (2.3%)	3 (4.8%)	1 (2.2%)	3 (4.6%)	0 (0%)	0.2 (0.3%)
	AN	1 (1.5%)	2 (4.2%)	1 (1.6%)	2 (4.3%)	0 (0%)	0.5 (0.8%)
	BN	1 (2.3%)	3 (5.6%)	1 (2.2%)	3 (5.6%)	-0.1 (-0.2%)	0.5 (0.9%)
	D	2 (3.8%)	4 (6.8%)	2 (3.6%)	4 (6.6%)	1 (0.9%)	1 (1.3%)
	C	3 (5.6%)	7 (12.5%)	3 (5.2%)	7 (12.2%)	-0.2 (-0.3%)	0.3 (0.5%)
	All	2 (3%)	4 (6.5%)	2 (2.9%)	4 (6.3%)	0.1 (0.1%)	0.4 (0.7%)
Sep	W	0 (0.6%)	1 (2.5%)	1 (2%)	2 (4%)	0.1 (0.3%)	0.2 (0.3%)
	AN	1 (0.9%)	2 (3.2%)	1 (2.6%)	3 (4.9%)	1 (1.4%)	1 (0.9%)
	BN	2 (3.4%)	4 (6.8%)	2 (3.3%)	4 (6.8%)	1 (1.2%)	1 (1.7%)
	D	3 (4.5%)	5 (7.9%)	2 (3.9%)	4 (7.3%)	0.2 (0.3%)	-0.3 (-0.5%)
	C	3 (4.5%)	5 (8.9%)	3 (4.6%)	6 (9%)	-0.2 (-0.3%)	0.2 (0.2%)
	All	1 (2.6%)	3 (5.5%)	2 (3.1%)	3 (6.1%)	0.3 (0.5%)	0.3 (0.4%)
Oct	W	1 (2.6%)	3 (5.5%)	1 (2%)	3 (5%)	0.1 (0.1%)	0.2 (0.3%)
	AN	1 (2.5%)	3 (5%)	1 (1.7%)	2 (4.2%)	0.1 (0.1%)	0.2 (0.3%)
	BN	1 (2.4%)	3 (5.8%)	1 (2%)	3 (5.3%)	0 (0%)	0.2 (0.4%)
	D	2 (2.8%)	3 (6.2%)	1 (2.4%)	3 (5.8%)	0.1 (0.1%)	0.2 (0.4%)
	C	1 (2.4%)	3 (6%)	1 (2.5%)	3 (6.1%)	-0.3 (-0.5%)	0 (0%)
	All	1 (2.6%)	3 (5.7%)	1 (2.1%)	3 (5.3%)	0 (0%)	0.2 (0.3%)
Nov	W	1 (1.8%)	2 (4.3%)	1 (1.1%)	2 (3.6%)	-0.2 (-0.4%)	-0.1 (-0.2%)
	AN	1 (1.6%)	2 (4.2%)	1 (1.5%)	2 (4.1%)	-0.3 (-0.5%)	-0.1 (-0.2%)
	BN	1 (1.5%)	2 (4.6%)	1 (1%)	2 (4%)	-0.4 (-0.7%)	-0.2 (-0.3%)
	D	1 (1.7%)	2 (4.2%)	1 (1.6%)	2 (4.2%)	-0.1 (-0.3%)	-0.1 (-0.1%)
	C	1 (1.8%)	2 (4.3%)	1 (1.7%)	2 (4.2%)	-0.2 (-0.3%)	-0.1 (-0.3%)
	All	1 (1.7%)	2 (4.3%)	1 (1.4%)	2 (4%)	-0.2 (-0.4%)	-0.1 (-0.2%)
Dec	W	1 (1.1%)	1 (2.4%)	1 (1.7%)	1 (2.9%)	0 (0%)	-0.1 (-0.1%)
	AN	1 (1.5%)	2 (3.8%)	1 (1.5%)	2 (3.7%)	-0.2 (-0.4%)	0 (0%)
	BN	1 (1.5%)	2 (4.2%)	1 (1.8%)	2 (4.4%)	-0.1 (-0.2%)	0.04 (0.1%)
	D	1 (1.5%)	2 (4%)	1 (1.7%)	2 (4.2%)	-0.1 (-0.1%)	-0.1 (-0.1%)
	C	1 (1.8%)	2 (4%)	1 (2.2%)	2 (4.4%)	0.03 (0.1%)	-0.1 (-0.1%)
	All	1 (1.5%)	2 (3.5%)	1 (1.7%)	2 (3.8%)	-0.1 (-0.1%)	-0.04 (-0.1%)

[a] Positive value reflects higher water temperature under ESO than under EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-78. Mean Monthly Water Temperature (°F) in the Sacramento River at Jelly's Ferry under ESO, HOS, and LOS Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	46	47	46	47	46	47
	AN	46	47	46	47	46	47
	BN	46	46	46	47	46	47
	D	46	47	46	47	46	47
	C	46	47	46	47	46	47
	All	46	47	46	47	46	47
Feb	W	47	47	47	47	47	47
	AN	47	48	47	48	47	48
	BN	47	47	47	48	47	48
	D	47	48	47	48	47	48
	C	48	49	48	49	48	49
	All	47	48	47	48	47	48
Mar	W	49	49	49	49	49	50
	AN	50	51	50	51	50	51
	BN	50	51	50	51	50	51
	D	51	51	51	51	51	51
	C	51	52	51	52	51	52
	All	50	51	50	51	50	51
Apr	W	52	53	52	53	52	53
	AN	54	55	53	55	54	55
	BN	54	54	54	54	53	54
	D	53	54	53	54	53	54
	C	53	54	53	54	53	54
	All	53	54	53	54	53	54
May	W	56	57	56	57	56	57
	AN	56	56	56	56	56	56
	BN	56	56	56	57	56	56
	D	55	55	55	56	55	55
	C	56	57	56	57	56	57
	All	56	56	56	56	56	56
Jun	W	56	56	56	56	56	56
	AN	55	55	55	56	55	55
	BN	55	56	55	56	55	55
	D	55	56	55	56	55	56
	C	57	58	57	58	57	58
	All	56	56	56	56	56	56
Jul	W	56	57	56	57	56	57
	AN	55	56	55	56	55	56
	BN	55	57	55	56	56	57
	D	56	58	56	58	56	58
	C	60	62	59	61	60	62
	All	56	58	56	57	56	58

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Aug	W	57	59	57	58	57	59
	AN	57	59	57	58	57	59
	BN	57	59	57	58	57	59
	D	58	60	58	59	59	60
	C	63	67	61	66	63	66
	All	58	60	58	60	58	60
Sep	W	56	58	56	57	58	59
	AN	58	59	57	59	58	60
	BN	59	61	59	60	58	60
	D	60	62	60	62	60	62
	C	64	67	63	66	64	67
	All	59	61	59	60	59	61
Oct	W	56	57	56	57	55	57
	AN	56	57	56	57	56	57
	BN	56	58	56	57	56	57
	D	57	59	56	58	57	58
	C	58	60	57	59	58	59
	All	56	58	56	58	56	58
Nov	W	52	53	52	53	51	52
	AN	52	53	52	53	51	53
	BN	52	53	52	53	52	53
	D	52	54	52	54	52	53
	C	53	54	53	54	53	54
	All	52	53	52	53	52	53
Dec	W	47	48	47	48	48	48
	AN	47	48	47	48	47	48
	BN	48	49	48	49	48	49
	D	47	49	47	49	48	49
	C	48	49	48	49	48	49
	All	47	48	48	48	48	49

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

1 **Table 5C.5.2-79. Differences[a] between ESO Scenarios and HOS and LOS Scenarios in Mean Monthly**
2 **Water Temperature (°F) in the Sacramento River at Jelly's Ferry**

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	0.02 (0.1%)	0 (0%)	0.04 (0.1%)	0.1 (0.2%)
	AN	0.1 (0.1%)	0 (0%)	0 (0%)	0.2 (0.3%)
	BN	0 (0%)	0.1 (0.1%)	0 (0%)	0.1 (0.2%)
	D	0.1 (0.2%)	0 (0%)	0.1 (0.1%)	0.1 (0.2%)
	C	0.2 (0.4%)	-0.1 (-0.1%)	0.3 (0.6%)	0.1 (0.1%)
	All	0.1 (0.1%)	0 (0%)	0.1 (0.1%)	0.1 (0.2%)
Feb	W	0 (0%)	0 (0%)	0 (0%)	0.04 (0.1%)
	AN	0 (0%)	0 (0%)	0 (0%)	0.1 (0.1%)
	BN	0 (0%)	0.04 (0.1%)	0 (0%)	0.03 (0.1%)
	D	0.1 (0.1%)	0 (0%)	0.03 (0.1%)	0.03 (0.1%)
	C	0.1 (0.2%)	0.04 (0.1%)	0 (0%)	0 (0%)
	All	0.03 (0.1%)	0 (0%)	0 (0%)	0 (0.1%)
Mar	W	0 (0%)	0 (0%)	0 (0%)	0 (0.1%)
	AN	0 (0%)	0.05 (0.1%)	0 (0%)	0 (0%)
	BN	0 (0%)	0.1 (0.2%)	-0.1 (-0.2%)	-0.1 (-0.2%)
	D	0 (0%)	0.03 (0.1%)	0 (0%)	0 (0%)
	C	0.1 (0.2%)	0.1 (0.2%)	0 (0%)	0 (0%)
	All	0 (0%)	0.04 (0.1%)	0 (0%)	0 (0%)
Apr	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	-0.1 (-0.1%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0.2 (0.4%)	-0.1 (-0.1%)	0.04 (0.1%)
	D	0.1 (0.2%)	0.2 (0.4%)	-0.04 (-0.1%)	0.1 (0.1%)
	C	0.1 (0.2%)	-0.1 (-0.1%)	0 (0%)	-0.04 (-0.1%)
	All	0 (0%)	0.1 (0.1%)	-0.03 (-0.1%)	0 (0%)
May	W	0 (0%)	0.1 (0.2%)	0 (0%)	0 (0%)
	AN	0.1 (0.2%)	0.3 (0.4%)	0 (0%)	0.2 (0.4%)
	BN	0.2 (0.3%)	0.4 (0.8%)	-0.2 (-0.3%)	-0.1 (-0.1%)
	D	0.1 (0.3%)	0.4 (0.7%)	-0.1 (-0.2%)	-0.1 (-0.2%)
	C	-0.1 (-0.1%)	-0.2 (-0.4%)	-0.1 (-0.2%)	-0.1 (-0.1%)
	All	0.1 (0.1%)	0.2 (0.4%)	-0.1 (-0.1%)	0 (0%)
Jun	W	0.1 (0.1%)	0.3 (0.6%)	0 (0%)	-0.04 (-0.1%)
	AN	0.3 (0.6%)	0.7 (1.3%)	0 (0%)	0.1 (0.2%)
	BN	0.2 (0.3%)	0.3 (0.6%)	0 (0%)	-0.1 (-0.1%)
	D	0.1 (0.2%)	0.2 (0.4%)	-0.1 (-0.2%)	-0.1 (-0.2%)
	C	-0.1 (-0.2%)	-0.1 (-0.1%)	-0.1 (-0.1%)	0.1 (0.2%)
	All	0.1 (0.2%)	0.3 (0.5%)	0 (-0.1%)	0 (0%)
Jul	W	0 (0%)	-0.04 (-0.1%)	0 (0%)	0 (0%)
	AN	-0.2 (-0.4%)	-0.2 (-0.3%)	0.1 (0.1%)	0 (0%)
	BN	0.1 (0.1%)	-0.2 (-0.4%)	0.2 (0.3%)	0.1 (0.2%)
	D	0 (0%)	-0.6 (-1%)	-0.2 (-0.3%)	-0.3 (-0.5%)
	C	-0.5 (-0.8%)	-0.9 (-1.5%)	0.1 (0.2%)	-0.1 (-0.2%)
	All	-0.1 (-0.2%)	-0.3 (-0.6%)	0 (0%)	-0.1 (-0.1%)

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	-0.1 (-0.2%)	-0.3 (-0.5%)	0 (0%)	0.1 (0.1%)
	AN	-0.2 (-0.4%)	-0.6 (-1.1%)	0.1 (0.1%)	-0.03 (-0.1%)
	BN	-0.2 (-0.3%)	-0.6 (-1%)	0.2 (0.3%)	0.1 (0.2%)
	D	-0.8 (-1.4%)	-0.8 (-1.4%)	0.2 (0.3%)	-0.1 (-0.2%)
	C	-1.4 (-2.2%)	-1.2 (-1.8%)	0.2 (0.3%)	-0.3 (-0.5%)
	All	-0.5 (-0.8%)	-0.6 (-1.1%)	0.1 (0.2%)	0 (0%)
Sep	W	-0.1 (-0.2%)	-0.2 (-0.3%)	1.1 (2%)	1.9 (3.2%)
	AN	-0.4 (-0.7%)	-0.5 (-0.8%)	0.3 (0.5%)	1.1 (1.9%)
	BN	0 (0%)	-0.7 (-1.1%)	-0.7 (-1.2%)	-0.7 (-1.1%)
	D	-0.4 (-0.7%)	-0.5 (-0.7%)	-0.3 (-0.5%)	-0.4 (-0.7%)
	C	-1.4 (-2.2%)	-0.7 (-1.1%)	-0.3 (-0.5%)	-0.3 (-0.4%)
	All	-0.4 (-0.7%)	-0.5 (-0.8%)	0.2 (0.3%)	0.5 (0.8%)
Oct	W	-0.05 (-0.1%)	0 (0%)	-0.2 (-0.3%)	-0.4 (-0.7%)
	AN	0 (0%)	-0.1 (-0.1%)	-0.3 (-0.5%)	-0.4 (-0.7%)
	BN	-0.1 (-0.2%)	-0.3 (-0.4%)	-0.1 (-0.2%)	-0.4 (-0.7%)
	D	-0.3 (-0.4%)	-0.3 (-0.4%)	-0.1 (-0.1%)	-0.4 (-0.7%)
	C	-0.6 (-1.1%)	-0.3 (-0.5%)	-0.1 (-0.1%)	-0.2 (-0.4%)
	All	-0.2 (-0.3%)	-0.2 (-0.3%)	-0.1 (-0.2%)	-0.4 (-0.6%)
Nov	W	0 (0%)	0 (0%)	-0.1 (-0.2%)	-0.4 (-0.7%)
	AN	0.1 (0.3%)	0.04 (0.1%)	-0.2 (-0.4%)	-0.3 (-0.6%)
	BN	0.05 (0.1%)	-0.1 (-0.2%)	-0.04 (-0.1%)	-0.4 (-0.7%)
	D	-0.03 (-0.1%)	0 (0%)	-0.1 (-0.1%)	-0.2 (-0.4%)
	C	-0.2 (-0.3%)	-0.1 (-0.2%)	-0.1 (-0.1%)	-0.1 (-0.1%)
	All	0 (0%)	-0.04 (-0.1%)	-0.1 (-0.2%)	-0.3 (-0.5%)
Dec	W	0.1 (0.2%)	0.1 (0.1%)	0.2 (0.4%)	0.2 (0.5%)
	AN	0.1 (0.2%)	0.1 (0.2%)	-0.1 (-0.2%)	-0.1 (-0.3%)
	BN	0.03 (0.1%)	-0.1 (-0.2%)	0.03 (0.1%)	0.03 (0.1%)
	D	0 (0%)	-0.1 (-0.1%)	0.1 (0.2%)	0.1 (0.2%)
	C	0 (0%)	0.05 (0.1%)	0.1 (0.1%)	0.1 (0.2%)
	All	0.04 (0.1%)	0 (0%)	0.1 (0.2%)	0.1 (0.2%)

[a] Positive value indicates higher temperature under HOS or LOS than under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

The exceedances of daily water temperatures above a 63°F threshold at Bend Bridge during May through September requested by NMFS were used to evaluate the potential water temperature-related effects of BDCP on green sturgeon spawning and egg incubation conditions (Section 5C.4, Table 5C.4-3). In addition, the number of days on which temperature exceeded 63°F by >0.5°F to >5°F in 0.5°F increments was determined for each month (May through September) and year of the 82-year modeling period. The combination of number of days and degrees above the 63°F threshold were further assigned a "level of concern", as defined in Section 5C.4, Table 5C.4-4. The highest level of concern across all months and all 82 modeled years for each model scenario is presented in Table 5C.5.2-80. Differences between EBC and ESO model scenarios are presented in Table 5C.5.2-81 and between EBC2 scenarios and HOS and LOS scenarios in Table 5C.5.2-82. The number of years with each level of concern would be similar between EBC2 and ESO scenarios in the ELT and LLT periods, indicating that there would be no effect of ESO on temperature conditions for green sturgeon spawning and egg incubation in the Sacramento River. Similarly, there would be negligible differences in the number of years with each level of concern between EBC2 scenarios and HOS and LOS scenarios indicating that there would be no effect of HOS and LOS on temperature conditions for green sturgeon spawning and egg incubation in the Sacramento River.

Table 5C.5.2-80. Number of Years in which Water Temperature Exceedances above 63°F Are Within Each Level of Concern, Sacramento River at Bend Bridge, May through September

Level of Concern[a]	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Red	4	3	7	13	7	14	6	13	7	12
Orange	1	3	1	1	1	2	0	0	1	2
Yellow	2	1	4	5	3	5	0	1	0	2
None	75	75	70	63	71	61	76	68	74	66

[a] For definitions of levels of concern, see Section 5C.4, Table 5C.4-4.

Table 5C.5.2-81. Differences between EBC and ESO Scenarios in the Number of Years in which Water Temperature Exceedances above 63°F Are Within Each Level of Concern, Sacramento River at Bend Bridge, May through September

Level of Concern[a]	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Red	3 (75%)	10 (250%)	11 (367%)	11 (367%)	0 (0%)	1 (8%)
Orange	0 (0%)	1 (100%)	-1 (-33%)	-1 (-33%)	0 (0%)	1 (100%)
Yellow	1 (50%)	3 (150%)	4 (400%)	4 (400%)	-1 (-25%)	0 (0%)
None	-4 (-5%)	-14 (-19%)	-14 (-19%)	-14 (-19%)	1 (1%)	-2 (-3%)

[a] For definitions of levels of concern, see Section 5C.4, Table 5C.4-4.

Table 5C.5.2-82. Differences between EBC2 Scenarios and HOS and LOS Scenarios in the Number of Years in which Water Temperature Exceedances above 63°F Are Within Each Level of Concern, Sacramento River at Bend Bridge, May through September

Level of Concern[a]	EBC2_ELT vs. HOS_ELT	EBC2_LLT vs. HOS_LLT	EBC2_ELT vs. LOS_ELT	EBC2_LLT vs. LOS_LLT
Red	-1 (-14%)	0 (0%)	0 (0%)	-1 (-8%)
Orange	-1 (-100%)	-1 (-100%)	0 (0%)	1 (100%)
Yellow	-4 (-100%)	-4 (-80%)	-4 (-100%)	-3 (-60%)
None	6 (9%)	5 (8%)	4 (6%)	3 (5%)

[a]For definitions of levels of concern, see Section 5C.4, Table 5C.4-4.

Degree-days exceeding 56°F at Bend Bridge were summed by month and water-year type during May through September and are presented in Table 5C.5.2-83. Differences between EBC and ESO model scenarios in degree-days are presented in Table 5C.5.2-84. The number of degree days exceeding the threshold would generally be similar between EBC2 and ESO scenarios. Although large relative differences (up to 750%) exist between scenarios, these differences correspond to small or negligible differences on an absolute scale. Therefore, this analysis indicates that there would be no temperature-related effects of the ESO on green sturgeon spawning and egg incubation conditions in the Sacramento River.

Differences between EBC2 scenarios and HOS and LOS scenarios in degree-days are presented in Table 5C.5.2-85. The number of degree-days would largely be similar between EBC2 and HOS scenarios during May through July except in crtical years in which there would be up to 39% (318 degree-days) fewer under HOS, indicating that HOS would provide a small to moderate temperature-related benefit to green sturgeon spawning and egg incubation conditions.

Table 5C.5.2-83. Total Degree-Days (°F-Days) by Month and Water-Year Type for Water Temperature Exceedances above 63°F in the Sacramento River at Bend Bridge, May through September

Month	Water-Year Type	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
May	W	13	13	30	68	30	64	30	59	30	61
	AN	0	0	2	5	0	0	1	6	0	0
	BN	0	0	0	2	0	4	0	2	0	4
	D	0	0	0	0	0	0	0	0	0	0
	C	0	0	1	1	2	4	1	4	2	4
	All	13	13	33	76	32	72	32	71	32	69
Jun	W	0	0	0	0	0	0	0	0	0	0
	AN	0	0	0	0	0	0	0	0	0	0
	BN	0	0	0	0	0	2	0	1	0	0
	D	0	0	0	0	0	0	0	0	0	0
	C	0	0	0	18	0	7	0	3	0	7
	All	0	0	0	18	0	9	0	4	0	7
Jul	W	0	0	0	0	0	0	0	0	0	0
	AN	0	0	0	0	0	0	0	0	0	0
	BN	0	0	0	0	0	1	0	0	0	0
	D	0	0	0	0	0	6	0	6	0	1
	C	8	14	167	638	137	668	77	426	162	631
	All	8	14	167	638	137	675	77	432	162	632
Aug	W	0	0	0	3	0	2	0	3	0	1
	AN	0	0	0	0	0	0	0	0	0	0
	BN	0	0	0	0	0	3	0	0	0	2
	D	0	1	29	66	28	118	23	57	27	106
	C	201	263	867	1762	811	1819	553	1496	788	1740
	All	201	264	896	1831	839	1942	576	1556	815	1849
Sep	W	0	0	0	0	0	0	0	0	0	5
	AN	0	0	0	2	0	17	0	10	5	31
	BN	0	0	1	13	4	77	5	52	1	38
	D	31	48	161	514	168	543	143	416	132	407
	C	267	265	808	1529	764	1534	490	1347	729	1445
	All	298	313	970	2058	936	2171	638	1825	867	1926

Table 5C.5.2-84. Differences between EBC and ESO Scenarios in Total Degree-Days (°F-Days) by Month and Water-Year Type for Water Temperature Exceedances above 63°F in the Sacramento River at Bend Bridge, May through September

Month	Water-Year Type	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
May	W	17 (131%)	51 (392%)	17 (131%)	51 (392%)	0 (0%)	-4 (-6%)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	-2 (-100%)	-5 (-100%)
	BN	0 (NA)	4 (NA)	0 (NA)	4 (NA)	0 (NA)	2 (100%)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	2 (NA)	4 (NA)	2 (NA)	4 (NA)	1 (100%)	3 (300%)
	All	19 (146%)	59 (454%)	19 (146%)	59 (454%)	-1 (-3%)	-4 (-5%)
Jun	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	2 (NA)	0 (NA)	2 (NA)	0 (NA)	2 (NA)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	0 (NA)	7 (NA)	0 (NA)	7 (NA)	0 (NA)	-11 (-61%)
	All	0 (NA)	9 (NA)	0 (NA)	9 (NA)	0 (NA)	-9 (-50%)
Jul	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	1 (NA)	0 (NA)	1 (NA)	0 (NA)	1 (NA)
	D	0 (NA)	6 (NA)	0 (NA)	6 (NA)	0 (NA)	6 (NA)
	C	129 (1613%)	660 (8250%)	123 (879%)	654 (4671%)	-30 (-18%)	30 (4.7%)
	All	129 (1613%)	667 (8338%)	123 (879%)	661 (4721%)	-30 (-18%)	37 (6%)
Aug	W	0 (NA)	2 (NA)	0 (NA)	2 (NA)	0 (NA)	-1 (-33%)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	3 (NA)	0 (NA)	3 (NA)	0 (NA)	3 (NA)
	D	28 (NA)	118 (NA)	27 (2700%)	117 (11700%)	-1 (-3%)	52 (79%)
	C	610 (303%)	1618 (805%)	548 (208%)	1556 (592%)	-56 (-6%)	57 (3%)
	All	638 (317%)	1741 (866%)	575 (218%)	1678 (636%)	-57 (-6%)	111 (6%)
Sep	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	17 (NA)	0 (NA)	17 (NA)	0 (NA)	15 (750%)
	BN	4 (NA)	77 (NA)	4 (NA)	77 (NA)	3 (300%)	64 (492%)
	D	137 (442%)	512 (1652%)	120 (250%)	495 (1031%)	7 (4%)	29 (6%)
	C	497 (186%)	1267 (475%)	499 (188%)	1269 (479%)	-44 (-5%)	5 (0%)
	All	638 (214%)	1873 (629%)	623 (199%)	1858 (594%)	-34 (-4%)	113 (5%)

Table 5C.5.2-85. Differences between EBC2 Scenarios and HOS and LOS Scenarios in Total Degree-Days (°F-Days) by Month and Water-Year Type for Water Temperature Exceedances above 63°F in the Sacramento River at Bend Bridge, May through September

Month	Water-Year Type	EBC2_ELT vs. HOS_ELT	EBC2_LLT vs. HOS_LLT	EBC2_ELT vs. LOS_ELT	EBC2_LLT vs. LOS_LLT
May	W	0 (0%)	-9 (-13%)	0 (0%)	-7 (-10%)
	AN	-1 (-50%)	1 (20%)	-2 (-100%)	-5 (-100%)
	BN	0 (NA)	0 (0%)	0 (NA)	2 (100%)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	0 (0%)	3 (300%)	1 (100%)	3 (300%)
	All	-1 (-3%)	-5 (-7%)	-1 (-3%)	-7 (-9%)
Jun	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	1 (NA)	0 (NA)	0 (NA)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	0 (NA)	-15 (-83%)	0 (NA)	-11 (-61%)
	All	0 (NA)	-14 (-78%)	0 (NA)	-11 (-61%)
Jul	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	D	0 (NA)	6 (NA)	0 (NA)	1 (NA)
	C	-90 (-54%)	-212 (-33%)	-5 (-3%)	-7 (-1%)
	All	-90 (-54%)	-206 (-32%)	-5 (-3%)	-6 (-1%)
Aug	W	0 (NA)	0 (0%)	0 (NA)	-2 (-67%)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	0 (NA)	0 (NA)	2 (NA)
	D	-6 (-21%)	-9 (-14%)	-2 (-7%)	40 (61%)
	C	-314 (-36%)	-266 (-15%)	-79 (-9 %)	-22 (-1%)
	All	-320 (-36%)	-275 (-15%)	-81 (-9%)	18 (1%)
Sep	W	0 (NA)	0 (NA)	0 (NA)	5 (NA)
	AN	0 (NA)	8 (400%)	5 (NA)	29 (1450%)
	BN	4 (400%)	39 (300%)	0 (0%)	25 (192%)
	D	-18 (-11%)	-98 (-19%)	-29 (-18%)	-107 (-21%)
	C	-318 (-39%)	-182 (-12%)	-79 (-10%)	-84 (-5%)
	All	-332 (-34%)	-233 (-11%)	-103 (-11%)	-132 (-6%)

The SacEFT model assumes that green sturgeon spawning only occurs below RBDD (river mile [RM] 242) during March 15–August 15. The SacEFT model uses 63°F (17°C) as the preferential upper temperature threshold of green sturgeon egg survival, which is categorized as "good," and 68°F (20°C) as a maximum threshold for green sturgeon spawning periods. SacEFT predicts that temperature conditions would be "good" in 89% and 87% of years under EBC1 and EBC2, respectively (Table 5C.5.2-86). SacEFT predicts that 68% and 71% of years would be good for eggs in the EBC2_ELT and ESO_ELT, respectively. SacEFT predicts that 33 and 32% of years would be good for eggs in the EBC2_LLT and ESO_LLT, respectively. These results indicate that, although climate change would greatly reduce temperature conditions for green sturgeon eggs, the ESO would not affect temperature conditions, which is consistent with the analysis of NMFS thresholds described in the previous paragraph.

Table 5C.5.2-86. Percentage of Years with Each Rating[a] for Temperature Conditions from SacEFT for Green Sturgeon Eggs in the Upper Sacramento River under EBC and ESO Scenarios

Rating	Scenario[b]					
	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Good	89	87	68	33	71	32
Worrisome	10	12	16	37	16	35
Poor	1	1	16	30	13	33

[a] Please refer to Attachment 5C.B, *Sacramento River Ecological Flows Tool (SacEFT): Record of Design (v.2.00)*, for definition of “good”, “worrisome”, and “poor”.
[b] See Table 5C.0-1 for definitions of the scenarios.

Overall, these three different methods provide consistent results indicating that there would be no water temperature-related effects of ESO, HOS, or LOS scenarios on green sturgeon spawning and egg incubation conditions in the Sacramento River.

Seasonal Flows

Sufficient flows are needed to oxygenate recently laid eggs and to limit disease and fungal infection (Deng et al. 2002; Parsley et al. 2002). Within the Sacramento River, spawning appears to be triggered by large increases in water flow during spawning (Brown 2007). Because flow relationships have been examined in more detail for white sturgeon (Kohlhorst et al. 1991) than green sturgeon (Israel and Klimley 2008), the white sturgeon analytical approach was utilized for investigating flow effects on eggs and embryo of green sturgeon. Eggs and embryos occur in the Sacramento River between Keswick and Wilkins Slough during March–July (Israel and Klimley 2008).

Mean monthly flows for the Sacramento River at Keswick and Wilkins Slough are presented in Table 5C.5.2-1 and Table 5C.5.2-58, respectively, and differences between pairs of model scenarios are presented in Table 5C.5.2-2 and Table 5C.5.2-59, respectively. Monthly frequency of exceedance plots for Sacramento River flows at Keswick and Wilkins Slough during the March though July period are presented in Figure 5C.5.2-3 through Figure 5C.5.2-8 and in Figure 5C.5.2-56 through Figure 5C.5.2-61, respectively.

Flows at Keswick under ESO_ELT would generally be similar to those under EBC2_ELT throughout the period with exceptions in some water-year types within months. In the LLT period, flows under ESO_LLT during March and July would generally be similar to flows under EBC2_LLT. During April through June, flows at Keswick under ESO_LLT would generally be up to 15% higher than flows under EBC2_LLT depending on month and water-year type.

At Wilkins Slough, patterns in flows were similar to those at Keswick. Flows under ESO_ELT would generally be similar to flows under EBC2_ELT with exceptions in some water-year types within months. In the LLT period, flows under ESO_LLT during March, April, and July would generally be similar to flows under EBC2_LLT. During May and June, flows at Wilkins Slough under ESO_LLT would generally be up to 15% higher than flows under EBC2_LLT depending on month and water-year type.

Flows at Keswick and Wilkins Slough under HOS and LOS scenarios would generally be similar to flows under the ESO scenario (Table 5C.5.2-5, Table 5C.5.2-6, Table 5C.5.2-19, Table 5C.5.2-21). Overall, these results suggest, with low certainty, that conditions for green sturgeon eggs and embryos in the Sacramento River would generally be similar between the ESO and EBC2 in each implementation period.

5C.5.2.1.7.2 Larvae

Water Temperature

The period of larval occurrence evaluated here (May through October) is modified from Israel and Klimley (2008) and Poytress et al. (2012) based on a shortened larval life stage. Larval rearing habitats for green sturgeon occur downstream of China Rapids and Iron Canyon spawning habitats (Israel and Klimley 2008). Therefore, water temperatures were analyzed at RBDD and Hamilton City using model outputs from SRWQM for each water-year type.

Predicted average water temperatures by month and water-year type for the Sacramento River at RBDD and Hamilton City are presented in Table 5C.5.2-87 and Table 5C.5.2-62, respectively and differences between model scenarios are presented in Table 5C.5.2-88 and Table 5C.5.2-63, respectively. These results indicate that there would be very small (<2%) differences in water temperature in either location in the Sacramento River between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT regardless of month and water-year type. Similarly, there would be no differences in water temperature at RBDD and Hamilton City between the ESO scenario and HOS and LOS scenarios (Table 5C.5.2-64, Table 5C.5.2-65, Table 5C.5.2-89, Table 5C.5.2-90). As a result, it is concluded with low certainty that there would be no temperature effects of ESO, HOS, and LOS scenarios on green sturgeon larval conditions in the Sacramento River.

Table 5C.5.2-87. Mean Monthly Water Temperature (°F) in the Sacramento River at Red Bluff Diversion Dam under EBC and ESO Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	45	45	46	46	46	46
	AN	45	45	46	47	46	47
	BN	44	44	45	46	45	46
	D	44	44	45	46	45	46
	C	44	44	45	47	45	47
	All	45	45	45	46	45	46
Feb	W	46	46	47	47	47	47
	AN	46	46	47	48	47	48
	BN	46	46	47	48	47	48
	D	46	46	47	48	47	48
	C	47	47	48	49	48	49
	All	46	46	47	48	47	48
Mar	W	48	48	49	50	49	50
	AN	49	49	50	51	50	51
	BN	49	49	50	51	50	51
	D	50	50	51	52	51	52
	C	51	51	51	53	51	52
	All	49	49	50	51	50	51
Apr	W	52	52	53	54	53	54
	AN	53	53	54	55	54	55
	BN	54	54	54	55	54	55
	D	54	54	54	55	54	55
	C	53	53	54	55	54	55
	All	53	53	54	55	54	55
May	W	55	55	57	58	57	58
	AN	56	56	58	58	57	58
	BN	56	56	58	58	57	58
	D	56	56	57	58	57	57
	C	57	57	58	59	58	59
	All	56	56	57	58	57	58
Jun	W	57	57	58	59	58	58
	AN	57	57	58	58	57	58
	BN	57	57	58	58	57	58
	D	57	57	58	59	58	59
	C	58	58	59	60	59	60
	All	57	57	58	59	58	58
Jul	W	58	58	58	59	58	59
	AN	57	57	58	59	58	59
	BN	57	57	58	59	58	59
	D	57	57	58	60	59	61
	C	60	60	62	64	62	64
	All	58	58	59	60	59	60

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Aug	W	58	58	60	61	60	61
	AN	59	58	60	61	59	61
	BN	58	58	59	61	59	61
	D	59	59	60	62	61	63
	C	61	62	65	68	65	69
	All	59	59	61	62	61	63
Sep	W	58	57	58	59	58	59
	AN	59	58	59	60	60	61
	BN	59	59	60	62	61	63
	D	59	60	62	64	62	64
	C	63	63	65	68	65	68
	All	59	59	60	62	61	62
Oct	W	55	55	56	57	56	58
	AN	55	55	56	57	56	58
	BN	55	55	56	58	56	58
	D	55	56	57	59	57	59
	C	56	56	58	60	58	60
	All	55	55	57	58	57	58
Nov	W	50	51	52	53	51	53
	AN	50	51	52	53	51	53
	BN	51	51	52	53	52	53
	D	51	51	52	53	52	53
	C	52	52	53	54	53	54
	All	51	51	52	53	52	53
Dec	W	46	46	47	48	47	48
	AN	46	46	47	48	47	48
	BN	46	46	47	48	47	48
	D	46	46	47	48	47	48
	C	46	46	47	48	47	48
	All	46	46	47	48	47	48

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-88. Differences[a] between EBC and ESO Scenarios in Mean Monthly Water Temperature (°F) in the Sacramento River at Red Bluff Diversion Dam

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	1 (1.5%)	1 (3.3%)	1 (1.6%)	2 (3.5%)	0.03 (0.1%)	0 (0%)
	AN	1 (1.6%)	2 (3.6%)	1 (1.7%)	2 (3.7%)	0 (0%)	0 (0%)
	BN	1 (2%)	2 (4%)	1 (2%)	2 (4.1%)	0.04 (0.1%)	0 (0%)
	D	1 (2%)	2 (4.3%)	1 (2%)	2 (4.4%)	0 (0%)	-0.05 (-0.1%)
	C	1 (2.2%)	2 (5.1%)	1 (2.1%)	2 (5.1%)	-0.1 (-0.2%)	-0.03 (-0.1%)
	All	1 (1.8%)	2 (4%)	1 (1.9%)	2 (4.1%)	0 (0%)	0 (0%)
Feb	W	1 (1.8%)	2 (3.5%)	1 (1.9%)	2 (3.5%)	0 (0%)	0 (0%)
	AN	1 (1.8%)	2 (3.6%)	1 (1.9%)	2 (3.7%)	0.04 (0.1%)	0 (0%)
	BN	1 (2%)	2 (3.8%)	1 (2%)	2 (3.8%)	0 (0%)	-0.02 (0%)
	D	1 (2.3%)	2 (4.2%)	1 (2.2%)	2 (4.1%)	0 (0%)	-0.03 (-0.1%)
	C	1 (2.3%)	2 (4.4%)	1 (2.3%)	2 (4.4%)	0 (0%)	-0.04 (-0.1%)
	All	1 (2%)	2 (3.8%)	1 (2%)	2 (3.9%)	0 (0%)	0 (0%)
Mar	W	1 (1.4%)	1 (3.1%)	1 (1.4%)	2 (3.1%)	0 (0%)	0 (0%)
	AN	1 (1.4%)	2 (3.3%)	1 (1.3%)	2 (3.2%)	-0.01 (-0.01%)	0.03 (0.1%)
	BN	1 (1.6%)	2 (3.6%)	1 (1.6%)	2 (3.6%)	0 (0%)	0.04 (0.1%)
	D	1 (1.6%)	2 (3.4%)	1 (1.6%)	2 (3.4%)	0 (0%)	-0.04 (-0.1%)
	C	1 (1.4%)	2 (3.3%)	1 (1.5%)	2 (3.4%)	-0.05 (-0.1%)	-0.2 (-0.4%)
	All	1 (1.5%)	2 (3.3%)	1 (1.5%)	2 (3.3%)	0 (0%)	-0.03 (-0.1%)
Apr	W	1 (1.6%)	2 (3.5%)	1 (1.6%)	2 (3.5%)	0 (0%)	0.02 (0%)
	AN	1 (1.5%)	2 (3.5%)	1 (1.5%)	2 (3.5%)	0 (0%)	-0.1 (-0.2%)
	BN	1 (1.8%)	2 (3.3%)	1 (1.6%)	2 (3.1%)	0 (0%)	-0.1 (-0.2%)
	D	1 (1.6%)	2 (3.2%)	1 (1.3%)	2 (3%)	-0.1 (-0.1%)	-0.2 (-0.3%)
	C	1 (1.8%)	2 (3.8%)	1 (1.5%)	2 (3.5%)	0 (0%)	-0.05 (-0.1%)
	All	1 (1.6%)	2 (3.5%)	1 (1.5%)	2 (3.3%)	0 (0%)	-0.1 (-0.1%)
May	W	2 (3.1%)	3 (5.1%)	2 (3%)	3 (5%)	0 (0%)	-0.3 (-0.4%)
	AN	1 (1.4%)	1 (2.2%)	1 (1.4%)	1 (2.2%)	-1 (-0.9%)	-1 (-1%)
	BN	1 (2.5%)	2 (3.4%)	1 (2.2%)	2 (3.1%)	-0.2 (-0.3%)	-0.4 (-0.7%)
	D	1 (2%)	1 (2.5%)	1 (1.8%)	1 (2.3%)	-0.3 (-0.5%)	-1 (-0.9%)
	C	1 (2%)	2 (3.6%)	1 (1.9%)	2 (3.4%)	0 (0%)	0.1 (0.1%)
	All	1 (2.4%)	2 (3.6%)	1 (2.2%)	2 (3.4%)	-0.2 (-0.3%)	-0.3 (-0.6%)
Jun	W	1 (1.5%)	1 (2%)	1 (1.5%)	1 (2%)	-0.1 (-0.2%)	-0.5 (-0.8%)
	AN	1 (1.2%)	1 (1.3%)	1 (1.4%)	1 (1.5%)	-0.2 (-0.4%)	-1 (-1.3%)
	BN	1 (1.3%)	1 (2.4%)	1 (1.3%)	1 (2.5%)	-0.3 (-0.4%)	-0.4 (-0.7%)
	D	1 (1.5%)	2 (3.2%)	1 (1.4%)	2 (3.1%)	-0.3 (-0.5%)	-0.2 (-0.4%)
	C	1 (1.4%)	2 (3.8%)	1 (1.5%)	2 (3.9%)	-0.2 (-0.3%)	0.2 (0.3%)
	All	1 (1.4%)	1 (2.5%)	1 (1.4%)	1 (2.5%)	-0.2 (-0.3%)	-0.4 (-0.6%)
Jul	W	0 (0.6%)	1 (2%)	0 (0.7%)	1 (2.1%)	-0.1 (-0.2%)	0.1 (0.1%)
	AN	1 (1.3%)	2 (3.1%)	1 (1.5%)	2 (3.3%)	0.08 (0.1%)	0.2 (0.4%)
	BN	1 (1.1%)	2 (3.8%)	1 (1.1%)	2 (3.8%)	-0.2 (-0.3%)	0.3 (0.5%)
	D	1 (2%)	3 (5.6%)	1 (1.9%)	3 (5.5%)	0.1 (0.2%)	1 (1.3%)
	C	2 (3.5%)	5 (8.2%)	2 (2.9%)	4 (7.5%)	-0.1 (-0.2%)	0 (0%)
	All	1 (1.5%)	2 (4.2%)	1 (1.5%)	2 (4.1%)	0 (-0.1%)	0.3 (0.5%)

Month	Water-Year Type[b]	Scenarios[c] EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Aug	W	1 (2.5%)	3 (5%)	1 (2.3%)	3 (4.9%)	0 (0%)	0.1 (0.2%)
	AN	1 (1.5%)	2 (4.2%)	1 (1.6%)	3 (4.3%)	-0.1 (-0.1%)	0.5 (0.7%)
	BN	1 (2.1%)	3 (5.6%)	1 (2.1%)	3 (5.5%)	-0.2 (-0.4%)	0.5 (0.8%)
	D	2 (3.9%)	4 (6.9%)	2 (3.8%)	4 (6.8%)	1 (1%)	1 (1.5%)
	C	3 (5.3%)	7 (11.8%)	3 (5%)	7 (11.5%)	-0.1 (-0.2%)	0.3 (0.4%)
	All	2 (3%)	4 (6.5%)	2 (2.9%)	4 (6.3%)	0.1 (0.1%)	0.4 (0.7%)
Sep	W	0 (0.4%)	1 (2.3%)	1 (2.2%)	2 (4.1%)	0.1 (0.2%)	0.11 (0.2%)
	AN	0 (0.7%)	2 (2.8%)	2 (2.7%)	3 (4.8%)	1 (1.4%)	1 (0.9%)
	BN	2 (3.3%)	4 (6.9%)	2 (3.3%)	4 (6.8%)	1 (1.1%)	1 (1.6%)
	D	3 (4.7%)	5 (7.9%)	2 (4.1%)	4 (7.2%)	0.3 (0.5%)	-0.3 (-0.5%)
	C	3 (4.4%)	5 (8.5%)	3 (4.4%)	5 (8.5%)	-0.1 (-0.1%)	0.1 (0.1%)
	All	1 (2.5%)	3 (5.3%)	2 (3.2%)	4 (6.1%)	0.3 (0.6%)	0.2 (0.4%)
Oct	W	1 (2.5%)	3 (5.4%)	1 (2.1%)	3 (4.9%)	0.1 (0.1%)	0.1 (0.2%)
	AN	1 (2.5%)	3 (5%)	1 (1.8%)	2 (4.3%)	0.1 (0.1%)	0.13 (0.2%)
	BN	1 (2.6%)	3 (5.7%)	1 (2.1%)	3 (5.3%)	0.01 (0.01%)	0.2 (0.4%)
	D	1 (2.7%)	3 (5.9%)	1 (2.4%)	3 (5.6%)	0.1 (0.1%)	0.2 (0.3%)
	C	1 (2.5%)	3 (5.9%)	1 (2.6%)	3 (6%)	-0.3 (-0.5%)	0 (0%)
	All	1 (2.6%)	3 (5.6%)	1 (2.2%)	3 (5.2%)	0 (0%)	0.1 (0.2%)
Nov	W	1 (1.9%)	2 (4.4%)	1 (1.2%)	2 (3.8%)	-0.2 (-0.4%)	-0.1 (-0.3%)
	AN	1 (1.7%)	2 (4.3%)	1 (1.6%)	2 (4.3%)	-0.3 (-0.5%)	-0.1 (-0.2%)
	BN	1 (1.6%)	2 (4.8%)	1 (1.1%)	2 (4.2%)	-0.4 (-0.7%)	-0.2 (-0.3%)
	D	1 (1.7%)	2 (4.4%)	1 (1.7%)	2 (4.3%)	-0.2 (-0.3%)	-0.1 (-0.2%)
	C	1 (1.9%)	2 (4.5%)	1 (1.8%)	2 (4.4%)	-0.1 (-0.3%)	-0.1 (-0.3%)
	All	1 (1.8%)	2 (4.5%)	1 (1.4%)	2 (4.1%)	-0.2 (-0.4%)	-0.1 (-0.3%)
Dec	W	1 (1.2%)	1 (2.6%)	1 (1.8%)	1 (3.1%)	0 (0%)	-0.1 (-0.1%)
	AN	1 (1.6%)	2 (4.1%)	1 (1.6%)	2 (4%)	-0.2 (-0.4%)	0 (0%)
	BN	1 (1.7%)	2 (4.4%)	1 (1.9%)	2 (4.7%)	-0.1 (-0.2%)	0.05 (0.1%)
	D	1 (1.6%)	2 (4.3%)	1 (1.8%)	2 (4.5%)	-0.1 (-0.1%)	-0.04 (-0.1%)
	C	1 (2%)	2 (4.4%)	1 (2.4%)	2 (4.7%)	0.04 (0.1%)	-0.04 (-0.1%)
	All	1 (1.6%)	2 (3.7%)	1 (1.9%)	2 (4%)	-0.1 (-0.1%)	-0.03 (-0.1%)

[a] Positive value indicates higher water temperature under ESO than under EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-89. Mean Monthly Water Temperature (°F) in the Sacramento River at Red Bluff Diversion Dam under ESO, HOS, and LOS Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	46	46	46	47	46	47
	AN	46	47	46	47	46	47
	BN	45	46	45	46	45	46
	D	46	46	46	46	46	46
	C	46	47	46	47	46	47
	All	46	46	46	46	46	47
Feb	W	47	47	47	47	47	48
	AN	47	48	47	48	47	48
	BN	47	48	47	48	47	48
	D	47	48	47	48	47	48
	C	48	49	48	49	48	49
	All	47	48	47	48	47	48
Mar	W	49	50	49	50	49	50
	AN	50	51	50	51	50	51
	BN	50	51	50	51	50	51
	D	51	52	51	52	51	52
	C	51	52	51	52	51	52
	All	50	51	50	51	50	51
Apr	W	52	54	52	54	52	54
	AN	54	55	54	55	54	55
	BN	54	55	54	56	54	55
	D	54	55	54	56	54	55
	C	53	55	54	55	53	55
	All	53	55	53	55	53	55
May	W	56	58	56	58	56	58
	AN	56	58	56	58	56	58
	BN	56	58	57	58	56	58
	D	56	57	56	57	56	57
	C	57	59	56	58	56	59
	All	56	58	56	58	56	58
Jun	W	56	58	57	59	56	58
	AN	56	58	56	58	56	58
	BN	56	58	56	58	56	58
	D	56	59	56	59	56	59
	C	57	60	57	60	57	60
	All	56	58	56	59	56	58
Jul	W	57	59	57	59	57	59
	AN	56	59	56	59	56	59
	BN	56	59	56	59	56	59
	D	57	61	57	60	57	60
	C	60	64	60	64	60	64
	All	57	60	57	60	57	60

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Aug	W	58	61	58	61	58	61
	AN	58	61	58	60	58	61
	BN	58	61	57	61	58	61
	D	59	63	58	62	59	63
	C	63	69	62	67	63	68
	All	59	63	58	62	59	63
Sep	W	57	59	57	59	58	61
	AN	58	61	58	60	59	62
	BN	60	63	60	62	59	62
	D	61	64	60	64	61	64
	C	64	68	63	67	64	68
	All	60	62	59	62	60	63
Oct	W	56	58	56	58	56	57
	AN	56	58	56	58	56	57
	BN	56	58	56	58	56	58
	D	57	59	57	59	57	58
	C	58	60	57	60	58	60
	All	56	58	56	58	56	58
Nov	W	51	53	51	53	51	52
	AN	51	53	52	53	51	52
	BN	52	53	52	53	52	53
	D	52	53	52	53	52	53
	C	53	54	53	54	53	54
	All	52	53	52	53	52	53
Dec	W	47	48	47	48	47	48
	AN	47	48	47	48	47	48
	BN	47	48	47	48	47	48
	D	47	48	47	48	47	48
	C	48	48	48	48	48	48
	All	47	48	47	48	47	48

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

1 **Table 5C.5.2-90. Differences[a] between ESO Scenarios and HOS and LOS Scenarios in Mean Monthly**
2 **Water Temperature (°F) in the Sacramento River at Red Bluff Diversion Dam**

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	0.02 (0%)	0 (0%)	0.04 (0.1%)	0.1 (0.2%)
	AN	0 (0.1%)	0 (0%)	0 (0%)	0.2 (0.3%)
	BN	0 (0%)	0.1 (0.1%)	0 (0%)	0.1 (0.2%)
	D	0.1 (0.1%)	0 (0%)	0.1 (0.1%)	0.1 (0.2%)
	C	0.2 (0.4%)	-0.1 (-0.2%)	0.3 (0.6%)	0.1 (0.1%)
	All	0.1 (0.1%)	0 (0%)	0.1 (0.1%)	0.1 (0.2%)
Feb	W	0 (0%)	0 (0%)	0 (0%)	0.04 (0.1%)
	AN	0 (0%)	0 (0%)	0 (0%)	0.1 (0.1%)
	BN	0 (0%)	0.03 (0.1%)	0 (0%)	0.02 (0.1%)
	D	0.1 (0.1%)	0 (0%)	0.03 (0.1%)	0.03 (0.1%)
	C	0.1 (0.2%)	0.02 (0%)	0 (0%)	0 (0%)
	All	0.03 (0.1%)	0 (0%)	0 (0%)	0 (0.1%)
Mar	W	0 (0%)	0 (0%)	0 (0%)	0 (0.1%)
	AN	0 (0%)	0.04 (0.1%)	0 (0%)	0 (0%)
	BN	0 (0%)	0.1 (0.1%)	-0.1 (-0.2%)	-0.1 (-0.2%)
	D	0 (0%)	0.03 (0.1%)	0 (0%)	0 (0%)
	C	0.1 (0.2%)	0.1 (0.2%)	0 (0%)	0 (0%)
	All	0 (0%)	0.04 (0.1%)	0 (0%)	0 (0%)
Apr	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (-0.1%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0.2 (0.4%)	-0.1 (-0.2%)	0.04 (0.1%)
	D	0.1 (0.2%)	0.2 (0.4%)	-0.04 (-0.1%)	0.1 (0.1%)
	C	0.1 (0.2%)	-0.1 (-0.1%)	0 (0%)	-0.03 (-0.1%)
	All	0 (0%)	0.1 (0.1%)	-0.03 (-0.1%)	0 (0%)
May	W	0 (0%)	0.1 (0.2%)	0 (0%)	0 (0%)
	AN	0.1 (0.2%)	0.3 (0.5%)	0 (0%)	0.2 (0.4%)
	BN	0.2 (0.3%)	0.5 (0.8%)	-0.2 (-0.3%)	-0.1 (-0.1%)
	D	0.1 (0.3%)	0.4 (0.7%)	-0.1 (-0.2%)	-0.1 (-0.2%)
	C	-0.1 (-0.1%)	-0.2 (-0.3%)	-0.1 (-0.2%)	-0.1 (-0.1%)
	All	0.1 (0.1%)	0.2 (0.4%)	-0.1 (-0.1%)	0 (0%)
Jun	W	0.1 (0.1%)	0.4 (0.6%)	0 (0%)	-0.05 (-0.1%)
	AN	0.4 (0.6%)	0.8 (1.4%)	0 (0%)	0.1 (0.2%)
	BN	0.2 (0.4%)	0.4 (0.7%)	0 (0%)	-0.1 (-0.2%)
	D	0.1 (0.2%)	0.3 (0.5%)	-0.1 (-0.2%)	-0.1 (-0.2%)
	C	-0.1 (-0.2%)	0 (0%)	-0.1 (-0.1%)	0.1 (0.2%)
	All	0.1 (0.2%)	0.4 (0.6%)	0 (-0.1%)	0 (0%)
Jul	W	0 (0%)	-0.02 (0%)	0 (0%)	0 (0%)
	AN	-0.2 (-0.4%)	-0.1 (-0.2%)	0.1 (0.1%)	0 (0%)
	BN	0.1 (0.1%)	-0.2 (-0.3%)	0.2 (0.3%)	0.1 (0.2%)
	D	0 (0%)	-0.6 (-1%)	-0.2 (-0.3%)	-0.3 (-0.5%)
	C	-0.4 (-0.7%)	-0.9 (-1.3%)	0.1 (0.2%)	-0.1 (-0.1%)
	All	-0.1 (-0.1%)	-0.3 (-0.5%)	0 (0%)	-0.1 (-0.1%)

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	-0.1 (-0.2%)	-0.3 (-0.5%)	0 (0%)	0 (0.1%)
	AN	-0.2 (-0.4%)	-0.7 (-1.1%)	0.1 (0.1%)	-0.06 (-0.1%)
	BN	-0.1 (-0.3%)	-0.6 (-0.9%)	0.2 (0.3%)	0.2 (0.2%)
	D	-0.8 (-1.4%)	-0.9 (-1.5%)	0.2 (0.3%)	-0.1 (-0.2%)
	C	-1.3 (-2.1%)	-1.2 (-1.8%)	0.2 (0.3%)	-0.4 (-0.6%)
	All	-0.5 (-0.8%)	-0.7 (-1.1%)	0.1 (0.2%)	0 (-0.1%)
Sep	W	-0.1 (-0.2%)	-0.2 (-0.4%)	1.2 (2.1%)	2.3 (3.9%)
	AN	-0.4 (-0.7%)	-0.5 (-0.9%)	0.3 (0.5%)	1.4 (2.3%)
	BN	0 (0%)	-0.7 (-1%)	-0.7 (-1.2%)	-0.7 (-1.2%)
	D	-0.4 (-0.7%)	-0.5 (-0.7%)	-0.3 (-0.6%)	-0.4 (-0.6%)
	C	-1.3 (-2%)	-0.7 (-1%)	-0.3 (-0.4%)	-0.2 (-0.3%)
	All	-0.4 (-0.6%)	-0.5 (-0.7%)	0.2 (0.3%)	0.7 (1.1%)
Oct	W	-0.05 (-0.1%)	0 (0%)	-0.2 (-0.3%)	-0.3 (-0.6%)
	AN	0 (0%)	-0.1 (-0.1%)	-0.2 (-0.4%)	-0.3 (-0.5%)
	BN	-0.1 (-0.2%)	-0.2 (-0.4%)	-0.1 (-0.2%)	-0.4 (-0.6%)
	D	-0.2 (-0.4%)	-0.2 (-0.4%)	-0.1 (-0.1%)	-0.3 (-0.5%)
	C	-0.6 (-1%)	-0.3 (-0.5%)	-0.1 (-0.1%)	-0.2 (-0.3%)
	All	-0.2 (-0.3%)	-0.1 (-0.3%)	-0.1 (-0.2%)	-0.3 (-0.5%)
Nov	W	0 (0%)	0 (0%)	-0.1 (-0.2%)	-0.3 (-0.6%)
	AN	0.1 (0.3%)	0.05 (0.1%)	-0.2 (-0.4%)	-0.3 (-0.6%)
	BN	0.05 (0.1%)	-0.1 (-0.2%)	-0.05 (-0.1%)	-0.3 (-0.6%)
	D	-0.03 (-0.1%)	0 (0%)	-0.1 (-0.1%)	-0.2 (-0.4%)
	C	-0.2 (-0.3%)	-0.1 (-0.2%)	-0.1 (-0.1%)	-0.1 (-0.1%)
	All	0 (0%)	-0.03 (-0.1%)	-0.1 (-0.2%)	-0.3 (-0.5%)
Dec	W	0.1 (0.2%)	0.1 (0.1%)	0.2 (0.4%)	0.2 (0.5%)
	AN	0.1 (0.2%)	0.1 (0.1%)	-0.1 (-0.2%)	-0.1 (-0.2%)
	BN	0.03 (0.1%)	-0.1 (-0.2%)	0.03 (0.1%)	0.04 (0.1%)
	D	0 (0%)	-0.1 (-0.2%)	0.1 (0.2%)	0.1 (0.2%)
	C	0 (0%)	0.03 (0.1%)	0 (0.1%)	0.1 (0.3%)
	All	0.04 (0.1%)	0 (0%)	0.1 (0.2%)	0.1 (0.2%)

[a] Positive value indicates higher water temperature under HOS or LOS than under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

5C.5.2.1.7.3 Juveniles

Water Temperature

Young of the year juvenile green sturgeon occur within the middle to lower Sacramento River from August to March (Israel and Klimley 2008). Predicted average water temperatures by month and water-year type for the Sacramento River at Hamilton City, the farthest downstream location modeled by SWRQM, are presented in Table 5C.5.2-62 and differences between model scenarios are presented in Table 5C.5.2-63. These results indicate that there would be very small (<2%) differences in water temperature at Hamilton City between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT regardless of month and water-year type. Similarly, there would be no differences in water temperature at Hamilton City between the ESO scenario and HOS and LOS scenarios (Table 5C.5.2-64, Table 5C.5.2-65), As a result, it is concluded with low certainty that there would be no temperature effects of ESO, HOS, and LOS scenarios on green sturgeon juvenile conditions in the Sacramento River.

5C.5.2.1.7.4 Adults

Water Temperature

The analysis of water temperature-related effects of the ESO on spawning adult green sturgeon in the Sacramento River are presented as part of the Egg and Embryo section above. These results indicate that there would be no temperature-related effects of the ESO on green sturgeon spawners in the Sacramento River throughout the March through July spawning and egg incubation period (Seesholtz and Moyle 2002; Adams et al. 2007; Mora et al. 2009; California Department of Water Resources 2011).

Spawning Habitat

In the absence of a green sturgeon-specific index, the Gard (1996) suitability index for Sacramento white sturgeon spawning habitat was utilized as a general guideline for green sturgeon. As mentioned above for white sturgeon, this index identified waters with velocities of 3.9–19.95 ft/s as suitable, with velocities of 5–12.5 ft/s as ideal. Further, water depths of >6 feet were suitable, while those >10 feet were ideal. In addition, whereas habitats with snags and gravel were considered suitable, those that included cobble and boulders were ideal. These criteria, combined with water temperatures upper thresholds, help identify preferential spawning habitats.As discussed above, there would be no temperature-related effects on green sturgeon spawning habitat in the Sacramento River (Table 5C.5.2-15, Table 5C.5.2-17, Table 5C.5.2-76, Table 5C.5.2-77)

Due to Sacramento River channel confinement, upstream supply of sediment and large woody debris is limited, which limits in-water refuge for fish, and contributes to the lack of sediment and organic matter accumulation on the downstream side of the debris (U.S. Fish and Wildlife Service 2000). The presence of upstream dams further exacerbates this problem. In addition, channelization increases water velocities, depth, and substrate grain size. Mean flow rates were examined in the Sacramento River upstream of RBDD during the adult attraction and spawning period (November through June). Average flows by month and water-year type for each model scenario are presented in Table 5C.5.2-3 and differences between pairs of model scenarios are presented in Table 5C.5.2-4. Monthly frequency of exceedance plots during November through June are presented in Figure 5C.5.2-13 through Figure 5C.5.2-19 and Figure 5C.5.2-23 through Figure 5C.5.2-24. Flows under ESO_ELT and ESO_LLT during November would be 5% to 18% lower than flows under EBC2_ELT and EBC2_LLT, respectively. During December through May, flows would be similar between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT with very few exceptions. During June, flows would be similar between EBC2_ELT and ESO_ELT and would be up to 12% higher under ESO_LLT relative to EBC2_LLT. There would generally be limited or no differences in flows upstream of RBDD between the ESO scenarios and HOS and LOS scenarios (Table 5C.5.2-8). However, these differences would not have a biologically meaningful effect on the green sturgeon spawning population because they are infrequent and lower magnitude. Based on these results, it was concluded with moderate certainty that there would be no flow-related effects on green sturgeon adult attraction and spawning habitat in the Sacramento River.

5C.5.2.1.8 Lamprey

5C.5.2.1.8.1 Eggs

Water Temperature

Exact spawning locations of Pacific and river lamprey in the Sacramento River are not well known. Therefore, this analysis includes the farthest upstream (Sacramento River below Keswick) and farthest downstream (Sacramento River at Hamilton City) locations to provide the widest range of temperature conditions. Pacific lamprey egg incubation in the Sacramento River occurs between January and August; river lamprey egg incubation occurs between February and June (Beamish 1980; Moyle 2002; Hannon and Deason 2007; Streif 2007; Luzier et al. 2009). Predicted average water temperatures by month and water-year type for the Sacramento River at Keswick and Hamilton City are presented in Table 5C.5.2-15 and Table 5C.5.2-62, respectively, and differences between model scenarios are presented in Table 5C.5.2-17 and Table 5C.5.2-63, respectively. These results indicate that there would be very small (<2%) differences in water temperature in the Sacramento River at Keswick or Hamilton City in all months and water-year types between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. Further, there would be very small differences in water temperature at these locations between the ESO scenario and HOS and LOS scenarios (Table 5C.5.2-19, Table 5C.5.2-21, Table 5C.5.2-64, Table 5C.5.2-65). Based on these results, it was concluded that there would be no temperature-related effects of the ESO, HOS, or LOS on Pacific or river lamprey egg incubation habitat and, therefore, no further biological analyses are reported. Because this analysis uses water temperature model outputs based on CALSIM outputs, error has been propagated and the level of certainty of these results is moderate.

Redd Dewatering

To determine the effects of the ESO on redd dewatering risk to Pacific and river lamprey in the Sacramento River, the number and frequency of redd “cohorts” experiencing a month-over-month (from one month to the next) decrease in flow of greater than 50%, which is assumed here to represent a redd dewatering event, at Keswick and Red Bluff was determined from CALSIM model outputs. Small-scale spawning location suitability characteristics (e.g., depth, velocity, and substrate) for lamprey are not adequately described to enable a more formal analysis, such as a weighted usable area analysis. Therefore, the change in month-over-month flows was used as a surrogate a month-over-month flow reduction of 50% was chosen as a best professional estimate of conditions in which redd dewatering is expected to occur, but this value does not estimate empirically-derived redd dewatering events. A “cohort” of eggs was assumed to be “born” every month during either January through August for Pacific lamprey or February through June for river lamprey. Because HOS and LOS flows do not differ meaningfully from ESO flows, no further analyses of redd dewatering risk were conducted for these model scenarios.

Results of the dewatering risk for Pacific lamprey are presented in Table 5C.5.2-91 and differences between pairs of model scenarios in redd dewatering risk are presented in Table 5C.5.2-92. The total number of redd cohorts at Keswick that would experience a 50% month-over-month flow decrease would be similar between EBC2_ELT and ESO_ELT, but would be 13% lower under ESO_LLT relative to EBC2_LLT. The total number of redd cohorts upstream of Red Bluff that would experience a 50% month-over-month flow decrease would be 8% higher under ESO_ELT relative to EBC2_ELT, but would be 14% lower under ESO_LLT relative to EBC2_LLT. These results indicate that there would be a small negative effect of the ESO on redd dewatering during the ELT, but a moderate benefit of the ESO during the LLT.

Table 5C.5.2-91. Dewatering Risk[a] of Pacific Lamprey Redd Cohorts under EBC and ESO Scenarios

Location	Metric	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Sacramento River at Keswick	# Cohorts	55	54	67	77	68	67
	Percent of total[c]	8%	8%	10%	12%	10%	10%
Sacramento River upstream of Red Bluff	# Cohorts	54	57	64	72	69	62
	Percent of total	8%	9%	10%	11%	11%	10%
Trinity River below Lewiston Dam	# Cohorts	131	129	129	131	130	129
	Percent of total	20%	20%	20%	20%	20%	20%
Feather River at Thermalito Afterbay	# Cohorts	150	109	113	108	124	120
	Percent of total	23%	17%	17%	17%	19%	18%
American River below Nimbus Dam	# Cohorts	84	92	106	121	111	124
	Percent of total	13%	14%	16%	19%	17%	19%
American River at Sacramento River Confluence	# Cohorts	95	100	118	135	126	139
	Percent of total	15%	15%	18%	21%	19%	21%
Stanislaus River at San Joaquin River Confluence	# Cohorts	58	61	62	60	61	60
	Percent of total	9%	9%	10%	9%	9%	9%

[a] Predicted number of and percent of total Pacific lamprey redd cohorts experiencing a month-over-month reduction in flows of greater than 50% during January to August for each model scenario.
[b] See Table 5C.0-1 for definitions of the scenarios.
[c]n = 655 cohorts for each location.

Table 5C.5.2-92. Differences[a] between EBC and ESO Scenarios in Dewatering Risk[b] of Pacific Lamprey Redd Cohorts

Location	Scenario[c]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Sacramento River at Keswick	13 (24%)[c]	12 (22%)	14 (26%)	13 (24%)	1 (2%)	-10 (-13%)
Sacramento River upstream of Red Bluff	15 (28%)	8 (15%)	12 (21%)	5 (9%)	5 (8%)	-10 (-14%)
Trinity River below Lewiston Dam	-1 (-1%)	-2 (-2%)	1 (1%)	0 (0%)	1 (1%)	-2 (-2%)
Feather River at Thermalito Afterbay	-26 (-17%)	-30 (-20%)	15 (14%)	11 (10%)	11 (10%)	12 (11%)
American River below Nimbus Dam	27 (32%)	40 (48%)	19 (21%)	32 (35%)	5 (5%)	3 (3%)
American River at Sacramento River Confluence	31 (33%)	44 (46%)	26 (26%)	39 (39%)	8 (7%)	4 (3%)
Stanislaus River at San Joaquin River Confluence	3 (5%)	2 (3%)	0 (0%)	-1 (-2%)	-1 (-2%)	0 (0%)

[a] Positive values indicate a higher risk of dewatering under ESO.
[b] Difference and percent difference between model scenarios in the number of Pacific lamprey redd cohorts experiencing a month-over-month reduction in flows of greater than 50%.
[c] See Table 5C.0-1 for definitions of the scenarios.

Results of the dewatering risk for river lamprey are presented in Table 5C.5.2-93 and differences between pairs of model scenarios in redd dewatering risk are presented in Table 5C.5.2-94. The total number of redd cohorts that would experience a 50% month-over-month flow decrease would be similar between the EBC2 and ESO at both Sacramento River locations in the ELT and LLT, except in the late long-term period upstream of Red Bluff, in which dewatering risk would be reduced under the ESO by 8%. These results indicate that there would generally be no effect of the ESO on river lamprey redd dewatering in the Sacramento River, except for a small benefit during the late long-term implementation period.

Because neither the exact locations of Pacific and river lamprey redds nor flow-WUA relationships for Pacific and river lamprey were used in this analysis, these results represent a relative estimate of redd dewatering among model scenarios. Therefore, there is low certainty in these conclusions.

Table 5C.5.2-93. Dewatering Risk[a] of River Lamprey Redd Cohorts under EBC and ESO Scenarios

Location	Metric	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Sacramento River at Keswick	Number	32	32	35	35	35	35
	Percent of total[c]	8%	8%	9%	9%	9%	9%
Sacramento River upstream of Red Bluff	Number	37	37	40	39	41	36
	Percent of total	9%	9%	10%	10%	10%	9%
Trinity River below Lewiston Dam	Number	71	72	69	69	69	67
	Percent of total	17%	18%	17%	17%	17%	16%
Feather River at Thermalito Afterbay	Number	68	60	68	58	65	60
	Percent of total	17%	15%	17%	14.%	16%	15%
American River below Nimbus Dam	Number	55	59	64	64	59	68
	Percent of total	13%	14%	16%	16%	14%	17%
American River at Sacramento River Confluence	Number	59	65	71	76	71	78
	Percent of total	14%	16%	17%	19%	17%	19%
Stanislaus River at San Joaquin River Confluence	Number	56	59	59	51	58	50
	Percent of total	14%	14%	14%	12%	14%	12%

[a] Predicted number of and percent of total Pacific lamprey redd cohorts experiencing a month-over-month reduction in flows of greater than 50% during January to August for each model scenario.
[b] See Table 5C.0-1 for definitions of the scenarios.
[c] n = 410 cohorts for each location.

Table 5C.5.2-94. Differences[a] between EBC and ESO Scenarios in Dewatering Risk[b] of River Lamprey Redd Cohorts

Location	Scenarios[c]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Sacramento River at Keswick	3 (9%)[c]	3 (9%)	3 (9%)	3 (9%)	0 (0%)	0 (0%)
Sacramento River upstream of Red Bluff	4 (11%)	-1 (-3%)	4 (11%)	-1 (-3%)	1 (3%)	-3 (-8%)
Trinity River below Lewiston Dam	-2 (-3%)	-4 (-6%)	-3 (-4%)	-5 (-7%)	0 (0%)	-2 (-3%)
Feather River at Thermalito Afterbay	-3 (-4%)	-8 (-12%)	5 (8%)	0 (0%)	-3 (-4%)	2 (3%)
American River below Nimbus Dam	4 (7%)	13 (24%)	0 (0%)	9 (15%)	-5 (-8%)	4 (6%)
American River at Sacramento River Confluence	12 (20%)	19 (32%)	6 (9%)	13 (20%)	0 (0%)	2 (3%)
Stanislaus River at San Joaquin River Confluence	2 (4%)	-6 (-11%)	-1 (-2%)	-9 (-15%)	-1 (-2%)	-1 (-2%)

[a] Positive values indicate a higher redd dewatering risk in the ESO than in EBC.
[b] Difference and percent difference between model scenarios in the number of Pacific lamprey redd cohorts experiencing a month-over-month reduction in flows of greater than 50%.
[c] See Table 5C.0-1 for definitions of the scenarios.

5C.5.2.1.8.2 Ammocoete

Water Temperature

Pacific lamprey ammocoetes rear upstream for five to seven years. River lamprey rear upstream for three to five years. For Pacific lamprey, water temperatures above 22°C (71.6°F) may cause significant death (~50%) or deformation of eggs and ammocoetes (Meeuwig et al. 2005). For river lamprey, no specific water temperature thresholds for ammocoetes have been established. Therefore, either 71.6°F, the Pacific lamprey ammocoete threshold, or 77°F, the river lamprey egg temperature threshold could be used to determine effects. As indicated above, there are no differences in Sacramento River water temperatures at Keswick and Hamilton City between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT (Table 5C.5.2-15, Table 5C.5.2-17, Table 5C.5.2-62, Table 5C.5.2-63). Further, there are no differences in water temperatures between ESO, HOS and LOS scenarios (Table 5C.5.2-19, Table 5C.5.2-21, Table 5C.5.2-64, Table 5C.5.2-65) Therefore, it was concluded with low certainty that there are no temperature-related effects of ESO, HOS, and LOS scenarios on Pacific or river lamprey ammocoetes in the Sacramento River. As a result, no further temperature analyses were conducted for lamprey ammocoetes in the Sacramento River.

Stranding

To determine the effects of the ESO on ammocoete stranding risk to Pacific and river lamprey in the Sacramento River, the number and frequency of ammocoete "cohorts" experiencing a month-over-month decrease in flow ranging from greater than 50% to greater than 90% at Keswick and upstream of RBDD was determined from CALSIM model outputs. The range of flow reductions was 50–90% (in 5% increments) and included the range in which model scenarios were distinguishable and indistinguishable from one another. For Pacific lamprey, a "cohort" of ammocoetes was assumed to be "born" every month during their spawning period (January–August) and spend five years rearing upstream. For river lamprey, cohorts were assumed to be born every month during February through June and spend five years rearing upstream. A cohort was considered "stranded" if at least one month-over-month flow reduction was greater than the each flow reduction at any time during the seven-year (for Pacific lamprey) or five-year rearing period (for river lamprey). Because HOS and LOS flows do not differ meaningfully from ESO flows, no further analyses of stranding risk were conducted for these model scenarios.

Sacramento River at Keswick

The number of Pacific lamprey ammocoete cohorts that may be affected by month-over-month flow reductions in the Sacramento River at Keswick is presented in Figure 5C.5.2-78, and differences between model scenarios are presented in Table 5C.5.2-95. As the severity of flow reductions approaches 90%, the number of exposed ammocoetes cohorts is predicted to decline because of the decreasing frequency of these severe dewatering events. Differences in the number of Pacific lamprey ammocoetes exposed to flow reductions between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT are predicted to be negligible for all flow reductions examined. These results indicate that there are no effects of flow reductions under the ESO on Pacific lamprey stranding risk. The majority of differences between model scenarios would be due to climate change.

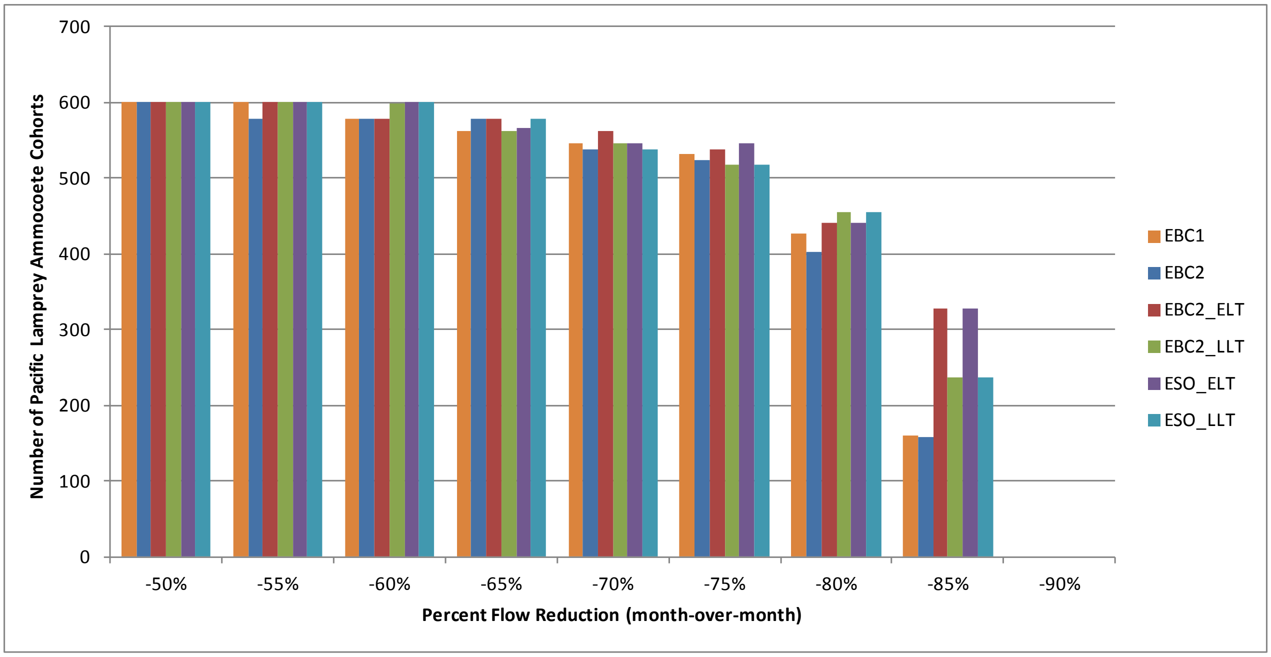


Figure 5C.5.2-78. Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions of 50% to 90%, Sacramento River at Keswick, under EBC and ESO Scenarios

Table 5C.5.2-95. Differences between EBC and ESO Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Sacramento River at Keswick

Flow Reduction	Percent Difference[a] between Scenarios[b]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC_ELT2 vs. ESO_ELT	EBC_LLT2 vs. ESO_LLT
50%	0	0	0	0	0	0
55%	0	0	4	4	0	0
60%	4	4	4	4	4	0
65%	1	3	-2	0	-2	3
70%	0	-1	2	0	-3	-1
75%	3	-3	5	-1	2	0
80%	4	7	10	13	0	0
85%	104	47	106	48	0	0
90%	NA	NA	NA	NA	NA	NA

[a] Negative values indicate reduced cohort exposure under the ESO.
[b] See Table 5C.0-1 for definitions of the scenarios.
NA = all values were 0.

For river lamprey, the number of ammocoete cohorts that may be affected by month-over-month flow reductions in the Sacramento River at Keswick is presented in Figure 5C.5.2-79 and differences between model scenarios are presented in Table 5C.5.2-96. As the severity of flow reductions approaches 90%, the number of exposed ammocoetes cohorts is predicted to decline because of the decreasing frequency of these severe dewatering events. Differences in the number of river lamprey ammocoetes exposed to flow reductions between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT are predicted to generally be negligible for all flow reductions examined, except in the

ELT at the 60% flow reduction (5% higher under ESO_ELT) and the 70% flow reduction (5% lower under ESO_ELT). These results indicate that there are generally no effects of flow reductions under the ESO on river lamprey stranding risk. The majority of differences between model scenarios would be due to climate change.

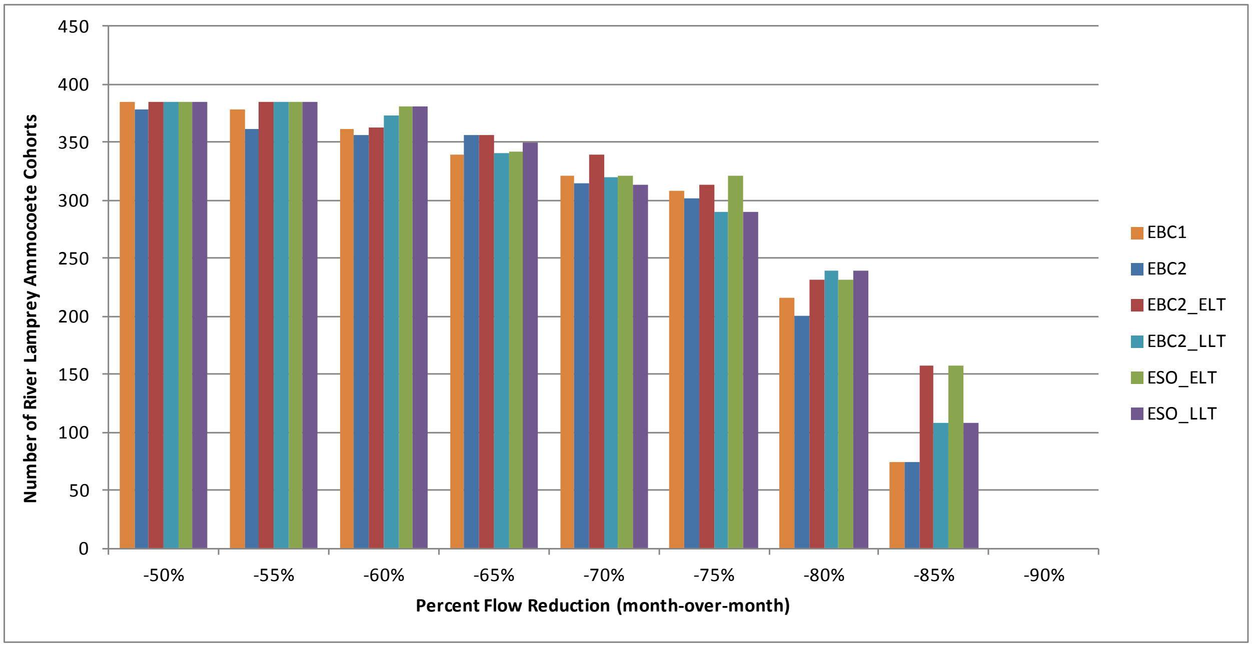


Figure 5C.5.2-79. Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions of 50% to 90%, Sacramento River at Keswick, under EBC and ESO Scenarios

Table 5C.5.2-96. Differences between EBC and ESO Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Sacramento River at Keswick

Flow Reduction	Percent Difference[a] between Scenarios[b]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
50%	0	0	2	2	0	0
55%	2	2	7	7	0	0
60%	6	6	7	7	5	2
65%	1	3	-4	-2	-4	3
70%	0	-2	2	0	-5	-2
75%	4	-6	6	-4	3	0
80%	7	11	15	19	0	0
85%	111	44	111	44	0	0
90%	NA	NA	NA	NA	NA	NA

[a] Negative values indicate reduced cohort exposure under the ESO.
[b] See Table 5C.0-1 for definitions of the scenarios.
NA = Could not be calculated because dividing by 0.

Sacramento River upstream of Red Bluff

The number of Pacific lamprey ammocoete cohorts that may be stranded by month-over-month flow reductions in the Sacramento River upstream of Red Bluff is presented in Figure 5C.5.2-80, and differences between model scenarios are presented in Table 5C.5.2-97. Differences in the number of Pacific lamprey ammocoetes exposed to flow reductions between EBC2_ELT and ESO_ELT are predicted to be negligible for all flow reductions examined. Differences EBC2_LLT and ESO_LLT are predicted to generally be negligible, except for the 75% flow reduction (9% lower under ESO_LLT) and 80% flow reduction (16% lower under ESO_LLT). These results indicate that there are generally no effects of flow reductions under the ESO on Pacific lamprey stranding risk in the ELT, and some small to moderate benefits of the ESO in the LLT. The majority of differences between model scenarios would be due to climate change.

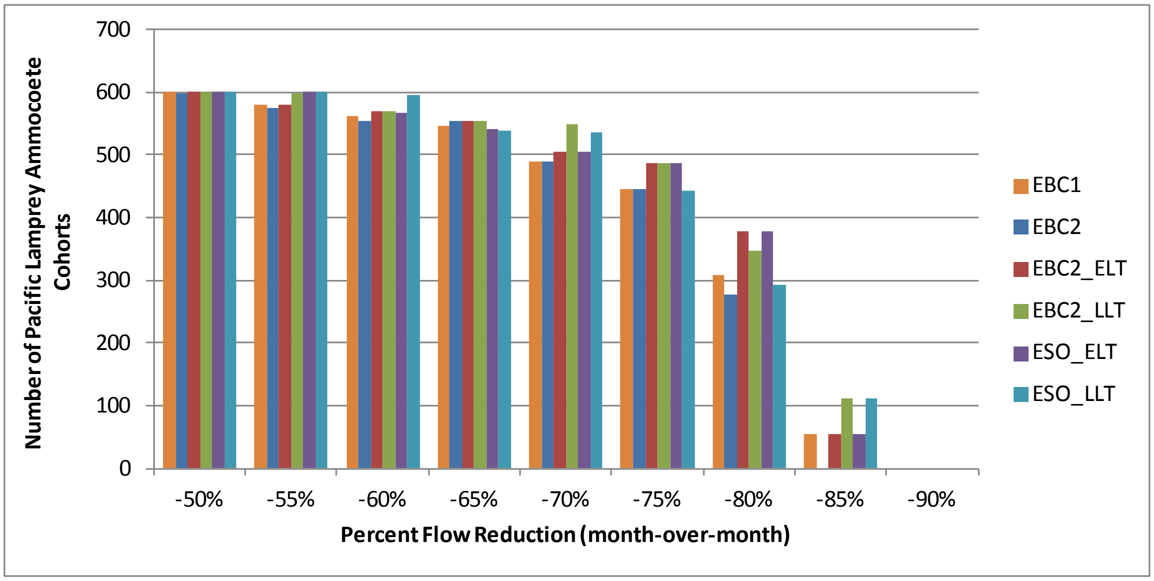


Figure 5C.5.2-80. Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions of 50% to 90%, Sacramento River Upstream of Red Bluff, under EBC and ESO Scenarios

Table 5C.5.2-97. Differences between EBC and ESO Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Sacramento River Upstream of Red Bluff

Flow Reduction	Percent Difference[a] in Scenarios[b]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
50%	0	0	0	0	0	0
55%	4	4	4	4	4	0
60%	1	6	3	8	-1	4
65%	-1	-1	-2	-3	-2	-3
70%	3	9	3	9	0	-2
75%	10	0	10	0	0	-9
80%	23	-6	36	5	0	-16
85%	0	100	NA	NA	0	0
90%	NA	NA	NA	NA	NA	NA

[a] Negative values indicate reduced cohort exposure under the ESO.
[b] See Table 5C.0-1 for definitions of the scenarios.
NA = Could not be calculated because dividing by 0.

The number of river lamprey ammocoete cohorts that may be stranded by month-over-month flow reductions in the Sacramento River upstream of Red Bluff is presented in Figure 5C.5.2-81 and differences between model scenarios are presented in Table 5C.5.2-98. Differences in the number of river lamprey ammocoetes exposed to flow reductions between EBC2_ELT and ESO_ELT are predicted to generally be negligible for all flow reductions examined, except for the 55% flow reduction (6% higher under ESO). Differences between EBC2_LLT and ESO_LLT are predicted to generally be negligible, except for the 60% flow reduction (5% higher under ESO_LLT), 75% flow reduction (10% lower under ESO), and 80% flow reduction (16% lower under ESO_LLT). These results indicate that there are generally no effects of flow reductions under the ESO on river lamprey stranding risk in the ELT, and some small to moderate benefits of the ESO in the LLT. The majority of differences between model scenarios would be due to climate change.

These results indicate that, overall, in both the early long-term and late long-term, Pacific and river lamprey ammocoetes are predicted to be exposed to flow reductions under the ESO in the Sacramento River at generally the same frequency as under existing biological conditions, with few exceptions. The majority of differences between model scenarios would be due to climate change.

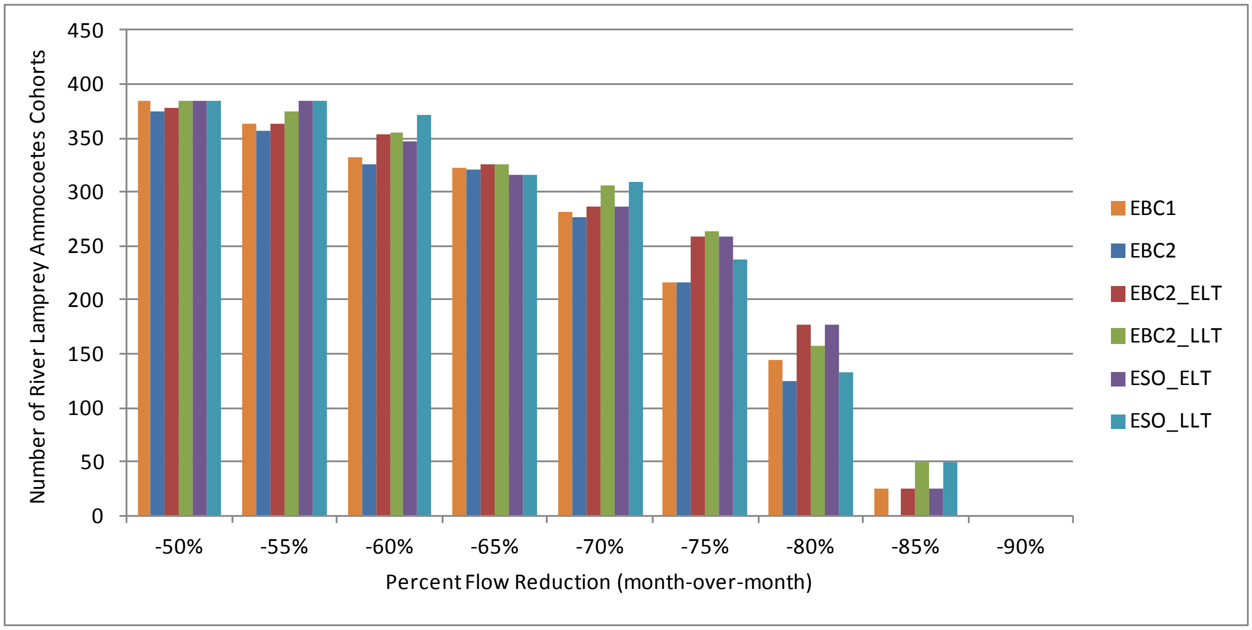


Figure 5C.5.2-81. Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions of 50% to 90%, Sacramento River Upstream of Red Bluff under EBC and ESO Scenarios

Table 5C.5.2-98. Differences between EBC and ESO Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Sacramento River Upstream of Red Bluff

Flow Reduction	Percent Difference[a] between Scenarios[b]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
50%	0	0	3	3	2	0
55%	6	6	8	8	6	3
60%	4	12	6	14	-2	5
65%	-2	-2	-2	-2	-3	-3
70%	2	10	3	12	0	1
75%	19	10	19	10	0	-10
80%	23	-8	42	6	0	-16
85%	0	100	NA	NA	0	0
90%	NA	NA	NA	NA	NA	NA

[a] Negative values indicate reduced cohort exposure, a benefit of the ESO.
[b] See Table 5C.0-1 for definitions of the scenarios.
NA = Could not be calculated because dividing by 0.

5C.5.2.2 Trinity River

5C.5.2.2.1 Lamprey

5C.5.2.2.1.1 Eggs

Water Temperature

Exact spawning locations of Pacific and river lamprey in the Trinity River are not well known. Therefore, this analysis includes upstream (below Lewiston Dam) and downstream (North Fork) locations that encompass the spatial range of the Reclamation water temperature model. Pacific lamprey egg incubation in the Trinity River occurs between January and August; river lamprey egg incubation occurs between February and June. Results for below Lewiston Dam by water-year type are presented in Table 5C.5.2-99 and differences between pairs of model scenarios are presented in Table 5C.5.2-100. Results for North Fork by water-year type are presented in Table 5C.5.2-101 and differences between pairs of model scenarios are presented in Table 5C.5.2-102. These results indicate that there would be negligible differences in mean monthly water temperatures between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT at both locations regardless of month or water-year type. Further, water temperatures in the Trinity River at Lewiston Dam and North Fork under HOS and LOS would not be different from those under the ESO during February through June spawning and egg incubation period (Table 5C.5.2-103, Table 5C.5.2-104, Table 5C.5.2-105, Table 5C.5.2-106). Therefore, it is concluded that there are no temperature-related effects of ESO, HOS, or LOS scenarios predicted on lamprey egg incubation habitat conditions. Because this analysis uses water temperature model outputs based on CALSIM outputs, error has been propagated and the level of certainty of these results is moderate.

Table 5C.5.2-99. Mean Monthly Water Temperature (°F) in the Trinity River below Lewiston Dam under EBC and ESO Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	41	41	42	43	42	43
	AN	38	39	39	41	40	41
	BN	39	39	40	41	39	41
	D	39	39	40	41	40	42
	C	39	39	40	42	40	42
	All	39	39	40	42	40	42
Feb	W	43	43	44	45	44	45
	AN	43	43	44	45	44	45
	BN	42	42	43	44	43	44
	D	42	42	44	45	44	45
	C	43	43	44	45	44	46
	All	43	43	44	45	44	45
Mar	W	46	46	47	48	47	48
	AN	47	47	48	49	48	49
	BN	47	47	47	48	47	48
	D	48	48	48	50	49	50
	C	48	48	49	50	49	50
	All	47	47	48	49	48	49
Apr	W	49	49	50	51	50	51
	AN	50	50	51	52	51	52
	BN	51	51	52	53	52	53
	D	51	51	52	53	52	53
	C	50	50	51	52	51	52
	All	50	50	51	52	51	52
May	W	46	46	47	48	47	48
	AN	46	46	47	48	47	48
	BN	46	46	48	49	48	49
	D	47	47	48	49	48	49
	C	49	49	51	52	51	52
	All	47	47	48	49	48	49
Jun	W	48	48	49	51	49	51
	AN	51	51	51	52	51	52
	BN	52	51	52	53	52	53
	D	52	52	53	54	52	54
	C	56	56	57	59	58	59
	All	51	51	52	53	52	53
Jul	W	51	51	53	55	53	54
	AN	52	52	52	54	52	52
	BN	52	52	53	55	53	55
	D	51	51	52	54	52	53
	C	53	53	56	60	56	61
	All	51	51	53	55	53	55

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Aug	W	52	52	53	54	52	54
	AN	51	51	52	53	51	53
	BN	52	52	54	55	53	55
	D	50	50	52	54	52	55
	C	54	54	60	63	59	64
	All	52	52	54	56	53	56
Sep	W	49	49	50	51	50	51
	AN	50	49	50	51	50	52
	BN	51	51	54	55	53	55
	D	50	50	53	56	53	56
	C	57	57	60	62	60	63
	All	51	51	53	54	52	55
Oct	W	48	48	50	51	49	51
	AN	49	50	51	52	50	52
	BN	50	50	52	53	52	53
	D	50	49	50	52	50	52
	C	51	52	54	56	53	55
	All	49	49	51	52	51	52
Nov	W	44	44	45	47	45	47
	AN	45	44	46	47	45	47
	BN	45	45	46	47	46	48
	D	44	44	45	47	45	47
	C	46	46	47	48	47	48
	All	45	45	46	47	46	47
Dec	W	41	41	42	43	42	43
	AN	39	39	41	43	40	43
	BN	40	40	41	42	40	42
	D	40	40	41	42	41	42
	C	39	39	40	41	40	41
	All	40	40	41	42	41	42

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-100. Differences[a] between EBC and ESO Scenarios in Mean Monthly Water Temperature (°F) in the Trinity River below Lewiston Dam

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	1 (2.3%)	2 (4.8%)	1 (2.6%)	2 (5.1%)	0 (0%)	-0.1 (-0.2%)
	AN	1 (3%)	2 (6.3%)	1 (2.3%)	2 (5.6%)	0.3 (0.6%)	0 (0%)
	BN	1 (1.4%)	2 (5.2%)	1 (1.8%)	2 (5.6%)	-0.2 (-0.5%)	-0.1 (-0.2%)
	D	1 (2.4%)	3 (7.5%)	1 (2.9%)	3 (7.9%)	-0.2 (-0.5%)	0.2 (0.4%)
	C	1 (2.3%)	2 (6%)	1 (2.2%)	2 (5.9%)	-0.1 (-0.3%)	0.1 (0.1%)
	All	1 (2.3%)	2 (5.8%)	1 (2.4%)	2 (6%)	-0.1 (-0.2%)	0 (0%)
Feb	W	1 (2.7%)	2 (5.5%)	1 (2.7%)	2 (5.4%)	0 (0%)	-0.04 (-0.1%)
	AN	1 (2.7%)	2 (5.2%)	1 (3.1%)	2 (5.6%)	0.1 (0.1%)	-0.05 (-0.1%)
	BN	1 (2.6%)	2 (5.1%)	1 (2.6%)	2 (5.1%)	0 (0%)	0 (0%)
	D	1 (2.7%)	2 (5.4%)	1 (2.6%)	2 (5.3%)	0 (0%)	0 (0%)
	C	1 (2.6%)	2 (5.4%)	1 (2.6%)	2 (5.5%)	0.03 (0.1%)	0.2 (0.3%)
	All	1 (2.7%)	2 (5.3%)	1 (2.7%)	2 (5.4%)	0 (0%)	0 (0%)
Mar	W	1 (1.7%)	2 (4.3%)	1 (1.3%)	2 (3.9%)	0 (0%)	0 (0%)
	AN	1 (1.3%)	2 (3.5%)	1 (1.5%)	2 (3.6%)	0.2 (0.4%)	-0.1 (-0.1%)
	BN	1 (1.7%)	2 (3.8%)	0.5 (1%)	1 (3.2%)	0 (0%)	-0.04 (-0.1%)
	D	0.4 (0.9%)	1 (3%)	1 (1.4%)	2 (3.4%)	0.1 (0.2%)	-0.1 (-0.1%)
	C	1 (2.1%)	2 (4.4%)	1 (1.7%)	2 (4%)	0 (0%)	0 (0%)
	All	1 (1.5%)	2 (3.8%)	1 (1.4%)	2 (3.6%)	0.04 (0.1%)	-0.03 (-0.1%)
Apr	W	1 (1.8%)	2 (4%)	1 (1.7%)	2 (3.9%)	0 (0%)	0.4 (0.9%)
	AN	1 (2.1%)	2 (4.6%)	1 (2.3%)	2 (4.9%)	0.2 (0.5%)	0.3 (0.7%)
	BN	1 (2.9%)	2 (4.9%)	1 (2.2%)	2 (4.2%)	0.1 (0.1%)	-0.03 (-0.1%)
	D	1 (1.8%)	2 (4.6%)	1 (1.2%)	2 (4%)	-0.1 (-0.2%)	0.1 (0.1%)
	C	1 (2%)	2 (4.3%)	1 (1.9%)	2 (4.2%)	0.2 (0.3%)	0 (0%)
	All	1 (2%)	2 (4.4%)	1 (1.8%)	2 (4.1%)	0.04 (0.1%)	0.2 (0.4%)
May	W	1 (2.5%)	2 (5.4%)	1 (2.5%)	2 (5.4%)	0 (0%)	0.04 (0.1%)
	AN	1 (2.3%)	2 (5%)	1 (2.3%)	2 (5%)	0 (0%)	0 (0%)
	BN	1 (2.6%)	2 (4.7%)	1 (2.7%)	2 (4.8%)	0.05 (0.1%)	0 (0%)
	D	1 (2.8%)	3 (5.4%)	1 (2.7%)	2 (5.3%)	0.04 (0.1%)	-0.03 (-0.1%)
	C	2 (3.7%)	3 (6.5%)	2 (3.4%)	3 (6.1%)	0 (0%)	0 (0%)
	All	1 (2.7%)	3 (5.4%)	1 (2.7%)	2 (5.3%)	0 (0%)	0 (0%)
Jun	W	1 (1.7%)	2 (4.5%)	1 (1.8%)	2 (4.6%)	0 (0%)	-0.1 (-0.1%)
	AN	1 (1.2%)	1 (2.2%)	1 (1%)	1 (2%)	-0.3 (-0.5%)	0 (0%)
	BN	1 (1.4%)	2 (3%)	1 (1.8%)	2 (3.5%)	0.1 (0.3%)	-0.3 (-0.5%)
	D	0.2 (0.4%)	2 (4.7%)	0.3 (0.5%)	3 (4.9%)	-0.4 (-0.7%)	0.2 (0.3%)
	C	2 (3.7%)	3 (5.3%)	2 (3.9%)	3 (5.4%)	0.2 (0.4%)	-0.8 (-1.3%)
	All	1 (1.6%)	2 (4.1%)	1 (1.7%)	2 (4.2%)	-0.1 (-0.1%)	-0.1 (-0.3%)
Jul	W	2 (4%)	3 (5.9%)	2 (3.9%)	3 (5.7%)	0.1 (0.2%)	-0.8 (-1.5%)
	AN	0.4 (0.8%)	1 (1.8%)	0.4 (0.8%)	1 (1.8%)	-0.4 (-0.7%)	-1 (-2.1%)
	BN	1 (1.7%)	3 (4.9%)	1 (1.6%)	3 (4.9%)	-0.03 (-0.1%)	-0.7 (-1.2%)
	D	1 (1.4%)	2 (4.9%)	1 (1.2%)	2 (4.7%)	-0.3 (-0.6%)	-0.2 (-0.3%)
	C	3 (5.6%)	8 (15%)	3 (5.7%)	8 (15.1%)	0 (0%)	1 (1.7%)
	All	1 (2.8%)	3 (6.3%)	1 (2.8%)	3 (6.2%)	-0.1 (-0.2%)	-0.4 (-0.8%)

Month	Water-Year Type[b]	Scenarios[c] EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Aug	W	0.4 (0.7%)	2 (3%)	1 (1.6%)	2 (3.9%)	-0.4 (-0.8%)	-0.5 (-0.9%)
	AN	0.4 (0.8%)	2 (4%)	0.4 (0.8%)	2 (4%)	-0.3 (-0.5%)	-0.2 (-0.3%)
	BN	1 (2.3%)	3 (6%)	1 (2.3%)	3 (6%)	-0.5 (-0.9%)	0.1 (0.2%)
	D	2 (3.5%)	5 (9.9%)	2 (3.6%)	5 (10%)	-0.03 (-0.1%)	0.9 (1.7%)
	C	5 (9%)	10 (18%)	4 (7.9%)	9 (16.8%)	-0.8 (-1.3%)	0.3 (0.4%)
	All	1 (2.9%)	4 (7.5%)	2 (3%)	4 (7.6%)	-0.4 (-0.7%)	0.1 (0.2%)
Sep	W	1 (1.2%)	2 (4.2%)	1 (2.1%)	2 (5.1%)	-0.2 (-0.4%)	0.1 (0.2%)
	AN	0 (1%)	2 (4.1%)	1 (3%)	3 (6.2%)	-0.1 (-0.2%)	0.3 (0.6%)
	BN	2 (3.5%)	4 (7.2%)	2 (3.1%)	3 (6.8%)	-0.6 (-1.2%)	0.1 (0.3%)
	D	3 (5%)	6 (12.7%)	2 (4.6%)	6 (12.2%)	-0.1 (-0.1%)	0.5 (0.9%)
	C	3 (5.4%)	6 (11.1%)	3 (5.4%)	6 (11.2%)	-0.1 (-0.2%)	0.6 (1%)
	All	2 (3.1%)	4 (7.7%)	2 (3.5%)	4 (8.1%)	-0.2 (-0.4%)	0.3 (0.6%)
Oct	W	2 (3.2%)	3 (6.2%)	1 (3.1%)	3 (6%)	-0.2 (-0.4%)	-0.3 (-0.5%)
	AN	1 (1.4%)	2 (5%)	0.2 (0.5%)	2 (4%)	-0.5 (-1%)	0.1 (0.2%)
	BN	2 (3.5%)	3 (6%)	2 (3.1%)	3 (5.5%)	0 (0%)	0.1 (0.2%)
	D	1 (1.4%)	3 (5.7%)	1 (2.1%)	3 (6.5%)	-0.1 (-0.2%)	0.6 (1.2%)
	C	2 (3.7%)	4 (7.6%)	2 (3%)	4 (6.8%)	-0.3 (-0.6%)	-0.5 (-1%)
	All	1 (2.7%)	3 (6.1%)	1 (2.5%)	3 (5.9%)	-0.2 (-0.4%)	0 (0%)
Nov	W	1 (2.5%)	3 (5.8%)	1 (2.4%)	3 (5.7%)	-0.1 (-0.1%)	-0.04 (-0.1%)
	AN	1 (1.7%)	2 (5.3%)	1 (3.1%)	3 (6.8%)	-0.1 (-0.3%)	0.1 (0.3%)
	BN	1 (2.9%)	3 (6.8%)	1 (2.9%)	3 (6.8%)	0 (0%)	0.5 (1.1%)
	D	1 (2.2%)	3 (6.6%)	1 (2%)	3 (6.4%)	-0.1 (-0.2%)	0.2 (0.4%)
	C	1 (3%)	2 (4.3%)	1 (3.1%)	2 (4.3%)	0.4 (0.8%)	-0.1 (-0.2%)
	All	1 (2.5%)	3 (5.8%)	1 (2.6%)	3 (6%)	0 (0%)	0.1 (0.2%)
Dec	W	1 (2.3%)	2 (4.7%)	1 (2%)	2 (4.4%)	-0.3 (-0.6%)	-0.2 (-0.4%)
	AN	1 (2.6%)	3 (8.6%)	1 (2.1%)	3 (8.1%)	-0.5 (-1.2%)	-0.2 (-0.5%)
	BN	1 (2.3%)	2 (6.3%)	1 (2.1%)	2 (6.1%)	-0.2 (-0.5%)	0 (0%)
	D	0.4 (1%)	2 (4.7%)	1 (2.2%)	2 (5.9%)	-0.1 (-0.3%)	0.04 (0.1%)
	C	1 (1.7%)	2 (4.5%)	1 (2.1%)	2 (4.9%)	0.02 (0.1%)	0 (0%)
	All	1 (2%)	2 (5.4%)	1 (2.1%)	2 (5.6%)	-0.2 (-0.5%)	-0.1 (-0.2%)

[a] Positive values indicate higher temperatures under ESO than under EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-101. Mean Monthly Water Temperature (°F) in the Trinity River at North Fork under EBC and ESO Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	40	40	40	41	40	41
	AN	38	38	39	39	39	39
	BN	38	38	38	39	38	39
	D	38	38	38	39	38	39
	C	38	38	39	40	39	40
	All	39	39	39	40	39	40
Feb	W	43	43	44	44	44	44
	AN	43	43	44	44	44	44
	BN	43	43	43	44	43	44
	D	43	43	43	44	43	44
	C	43	43	44	45	44	45
	All	43	43	44	44	44	44
Mar	W	46	46	46	47	46	47
	AN	46	46	47	47	47	47
	BN	46	47	47	47	47	47
	D	47	47	47	48	47	48
	C	48	48	48	49	48	49
	All	47	47	47	47	47	47
Apr	W	53	53	53	53	53	53
	AN	54	54	54	54	54	55
	BN	54	54	54	55	54	55
	D	54	54	54	55	54	55
	C	54	54	55	55	55	55
	All	53	53	54	54	54	55
May	W	50	50	51	52	51	52
	AN	50	50	51	52	51	52
	BN	51	51	52	53	52	53
	D	51	51	53	54	53	54
	C	54	54	56	57	56	57
	All	51	51	52	53	52	53
Jun	W	55	55	56	57	56	57
	AN	58	58	59	58	58	58
	BN	60	60	60	61	60	61
	D	62	61	62	64	62	64
	C	63	63	65	66	65	66
	All	59	59	60	61	60	61
Jul	W	63	63	64	66	64	66
	AN	63	63	64	66	64	65
	BN	65	65	65	67	65	67
	D	65	65	66	68	66	68
	C	68	68	69	71	69	71
	All	65	65	66	67	66	67

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Aug	W	65	65	66	68	66	67
	AN	64	64	65	67	65	67
	BN	65	65	66	68	66	68
	D	64	64	65	67	65	67
	C	65	65	68	69	67	70
	All	65	65	66	68	66	68
Sep	W	59	59	60	62	60	62
	AN	59	58	60	61	60	61
	BN	59	60	61	62	61	63
	D	58	58	60	62	60	62
	C	61	61	63	64	63	64
	All	59	59	61	62	61	62
Oct	W	53	53	54	55	54	55
	AN	53	53	54	55	54	55
	BN	54	54	55	56	55	56
	D	53	52	54	54	53	55
	C	54	54	55	56	55	56
	All	53	53	54	55	54	55
Nov	W	44	44	44	45	44	45
	AN	44	44	45	46	45	46
	BN	44	44	45	46	45	46
	D	44	44	44	45	44	45
	C	45	45	46	47	46	47
	All	44	44	45	46	45	46
Dec	W	41	41	41	42	41	42
	AN	40	40	41	42	41	41
	BN	39	39	40	41	40	41
	D	40	39	40	41	40	41
	C	38	38	39	40	39	40
	All	40	40	40	41	40	41

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-102. Differences[a] between EBC and ESO Scenarios in Mean Monthly Water Temperature (°F) in the Trinity River at North Fork

Month	Water-Year Type[b]	Scenarios[c] EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	1 (1.5%)	1 (2.6%)	1 (1.6%)	1 (2.7%)	0.03 (0.1%)	-0.1 (-0.2%)
	AN	0 (1.2%)	1 (2.7%)	0 (1.1%)	1 (2.6%)	0.04 (0.1%)	0 (0%)
	BN	0 (0.8%)	1 (2.7%)	0 (1.2%)	1 (3%)	-0.04 (-0.1%)	0 (0%)
	D	1 (1.6%)	2 (4.3%)	1 (1.7%)	2 (4.4%)	-0.04 (-0.1%)	0.03 (0.1%)
	C	1 (1.8%)	2 (4.5%)	1 (1.8%)	2 (4.4%)	-0.02 (-0.1%)	0 (0%)
	All	1 (1.4%)	1 (3.3%)	1 (1.5%)	1 (3.4%)	0 (0%)	0 (-0.1%)
Feb	W	1 (1.2%)	1 (2.4%)	1 (1.2%)	1 (2.4%)	0 (0%)	-0.02 (0%)
	AN	1 (1.3%)	1 (2.3%)	1 (1.5%)	1 (2.5%)	0 (0%)	0 (0%)
	BN	1 (1.4%)	1 (2.7%)	1 (1.3%)	1 (2.7%)	0 (0%)	0 (0%)
	D	1 (1.3%)	1 (2.5%)	1 (1.3%)	1 (2.5%)	0 (0%)	0 (0%)
	C	1 (1.7%)	1 (3.3%)	1 (1.7%)	1 (3.3%)	0.01 (0%)	0.02 (0.1%)
	All	1 (1.3%)	1 (2.6%)	1 (1.4%)	1 (2.6%)	0 (0%)	0 (0%)
Mar	W	0 (0.5%)	1 (1.6%)	0 (0.4%)	1 (1.6%)	0 (0%)	0 (0%)
	AN	0 (0.4%)	1 (1.3%)	0 (0.5%)	1 (1.4%)	0 (0%)	0 (0%)
	BN	0 (0.6%)	1 (1.6%)	0.2 (0.5%)	1 (1.5%)	0 (0%)	0 (0%)
	D	0.2 (0.5%)	1 (1.5%)	0 (0.6%)	1 (1.6%)	0 (0%)	0 (0%)
	C	0 (0.9%)	1 (2.2%)	0 (0.9%)	1 (2.2%)	0 (0%)	0 (0%)
	All	0 (0.6%)	1 (1.6%)	0 (0.5%)	1 (1.6%)	0 (0%)	0 (0%)
Apr	W	0 (0.7%)	1 (1.6%)	0 (0.6%)	1 (1.6%)	0 (0%)	0.05 (0.1%)
	AN	0 (0.7%)	1 (1.9%)	0 (0.8%)	1 (1.9%)	0.2 (0.3%)	0.1 (0.2%)
	BN	0 (0.8%)	1 (2%)	0 (0.7%)	1 (1.8%)	0 (0%)	0 (0%)
	D	0 (0.8%)	1 (2.2%)	0 (0.7%)	1 (2.1%)	0 (0%)	0 (0%)
	C	1 (1%)	1 (2.6%)	1 (1%)	1 (2.6%)	0 (0%)	0 (0%)
	All	0 (0.8%)	1 (2%)	0 (0.7%)	1 (1.9%)	0 (0%)	0.03 (0.1%)
May	W	1 (2.1%)	2 (4.2%)	1 (2.1%)	2 (4.2%)	0 (0%)	0 (0%)
	AN	1 (2%)	2 (4.1%)	1 (2%)	2 (4.2%)	0 (0%)	0 (0%)
	BN	1 (2.3%)	2 (3.7%)	1 (2.4%)	2 (3.7%)	0.03 (0.1%)	0 (0%)
	D	1 (2.3%)	2 (4.3%)	1 (2.3%)	2 (4.3%)	0 (0%)	0 (0%)
	C	2 (3.1%)	3 (5%)	2 (2.9%)	3 (4.8%)	0 (0%)	0 (0%)
	All	1 (2.3%)	2 (4.2%)	1 (2.3%)	2 (4.2%)	0 (0%)	0 (0%)
Jun	W	1 (1%)	2 (3.3%)	1 (1.1%)	2 (3.3%)	0 (0%)	-0.04 (-0.1%)
	AN	1 (1.3%)	1 (1.3%)	1 (1.2%)	1 (1.2%)	-0.1 (-0.2%)	0 (0%)
	BN	1 (1.1%)	2 (2.7%)	1 (1.1%)	2 (2.7%)	0.04 (0.1%)	-0.1 (-0.2%)
	D	0.7 (1.2%)	2 (3.7%)	0.7 (1.2%)	2 (3.7%)	-0.1 (-0.2%)	0.1 (0.1%)
	C	1 (2.1%)	2 (3.6%)	1 (2.1%)	2 (3.6%)	0.1 (0.1%)	-0.3 (-0.4%)
	All	1 (1.3%)	2 (3.1%)	1 (1.3%)	2 (3.1%)	0 (0%)	-0.1 (-0.1%)
Jul	W	2 (2.6%)	3 (4.9%)	2 (2.5%)	3 (4.9%)	0.05 (0.1%)	-0.3 (-0.5%)
	AN	0.6 (1%)	2 (2.7%)	0.6 (1%)	2 (2.7%)	-0.2 (-0.2%)	-0.5 (-0.7%)
	BN	1 (0.8%)	2 (3.1%)	0 (0.8%)	2 (3.1%)	0 (0%)	-0.3 (-0.4%)
	D	1 (1.3%)	3 (3.9%)	1 (1.2%)	2 (3.8%)	-0.1 (-0.1%)	0 (0%)
	C	1 (2.1%)	4 (5.4%)	1 (2.1%)	4 (5.4%)	0 (0%)	0.3 (0.5%)
	All	1 (1.7%)	3 (4.1%)	1 (1.6%)	3 (4.1%)	0 (0%)	-0.2 (-0.2%)

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Aug	W	1 (1.5%)	2 (3.7%)	1 (1.7%)	3 (3.9%)	-0.1 (-0.2%)	-0.1 (-0.2%)
	AN	1 (1.6%)	3 (4.1%)	1 (1.6%)	3 (4%)	-0.1 (-0.1%)	-0.04 (-0.1%)
	BN	1 (1.9%)	3 (4.4%)	1 (1.9%)	3 (4.4%)	-0.1 (-0.2%)	0.04 (0.1%)
	D	1 (2.3%)	3 (5.5%)	1 (2.3%)	3 (5.5%)	0 (0%)	0.2 (0.4%)
	C	2 (3.3%)	4 (6.8%)	2 (3.1%)	4 (6.6%)	-0.2 (-0.3%)	0.5 (0.8%)
	All	1 (2%)	3 (4.7%)	1 (2.1%)	3 (4.8%)	-0.1 (-0.2%)	0.1 (0.1%)
Sep	W	1 (1.9%)	3 (4.4%)	1 (2.1%)	3 (4.6%)	-0.1 (-0.1%)	0.03 (0.1%)
	AN	1 (1.9%)	3 (4.4%)	1 (2.4%)	3 (4.9%)	0 (0%)	0.1 (0.1%)
	BN	1 (2.4%)	3 (5.2%)	1 (2.3%)	3 (5.1%)	-0.2 (-0.3%)	0.1 (0.1%)
	D	2 (2.9%)	4 (6.6%)	2 (2.8%)	4 (6.5%)	0 (0%)	0.2 (0.2%)
	C	2 (3.1%)	3 (5.1%)	2 (3.2%)	3 (5.1%)	-0.5 (-0.7%)	0.1 (0.1%)
	All	1 (2.4%)	3 (5.1%)	1 (2.5%)	3 (5.2%)	-0.1 (-0.2%)	0.1 (0.1%)
Oct	W	1 (2%)	2 (3.6%)	1 (1.9%)	2 (3.5%)	-0.05 (-0.1%)	-0.1 (-0.1%)
	AN	1 (1.8%)	2 (3.4%)	0.9 (1.7%)	2 (3.2%)	0 (0%)	-0.1 (-0.1%)
	BN	1 (2.1%)	2 (3.7%)	1 (2%)	2 (3.6%)	0 (0%)	0.03 (0.1%)
	D	1 (1.7%)	2 (3.7%)	1 (1.9%)	2 (3.9%)	-0.03 (-0.1%)	0.2 (0.3%)
	C	1 (2.2%)	3 (4.7%)	1 (2%)	2 (4.6%)	-0.1 (-0.1%)	-0.04 (-0.1%)
	All	1 (2%)	2 (3.8%)	1 (1.9%)	2 (3.7%)	-0.03 (-0.1%)	0 (0%)
Nov	W	1 (1.7%)	2 (3.7%)	1 (1.7%)	2 (3.6%)	0 (0%)	-0.02 (-0.1%)
	AN	1 (1.5%)	2 (3.5%)	1 (1.8%)	2 (3.9%)	-0.03 (-0.1%)	0.03 (0.1%)
	BN	1 (2%)	2 (4.4%)	1 (2%)	2 (4.4%)	0 (0%)	0.1 (0.2%)
	D	1 (1.6%)	2 (4%)	1 (1.6%)	2 (3.9%)	-0.03 (-0.1%)	0.04 (0.1%)
	C	1 (1.9%)	2 (3.7%)	1 (1.9%)	2 (3.7%)	0.1 (0.2%)	-0.02 (-0.1%)
	All	1 (1.8%)	2 (3.8%)	1 (1.8%)	2 (3.9%)	0 (0%)	0 (0%)
Dec	W	1 (1.4%)	1 (2.4%)	1 (1.5%)	1 (2.5%)	0 (0%)	0.1 (0.1%)
	AN	1 (1.4%)	1 (3.7%)	1 (1.3%)	1 (3.6%)	-0.1 (-0.2%)	-0.1 (-0.1%)
	BN	1 (1.8%)	2 (4.3%)	1 (1.7%)	2 (4.2%)	-0.04 (-0.1%)	0 (0%)
	D	0.5 (1.4%)	1 (3.7%)	1 (1.5%)	2 (3.9%)	0 (0%)	0.03 (0.1%)
	C	1 (1.7%)	2 (4.9%)	1 (1.8%)	2 (5%)	0 (0%)	-0.03 (-0.1%)
	All	1 (1.5%)	1 (3.5%)	1 (1.5%)	1 (3.6%)	0 (0%)	0 (0%)

[a] Positive values indicate higher water temperature under ESO than under EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-103. Mean Monthly Water Temperature (°F) in the Trinity River below Lewiston Dam under ESO, HOS, and LOS Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	42	43	42	43	42	43
	AN	40	41	40	40	39	41
	BN	39	41	39	41	40	41
	D	40	42	39	41	40	41
	C	40	42	40	42	40	42
	All	40	42	40	41	40	42
Feb	W	44	45	44	45	44	45
	AN	44	45	44	45	44	45
	BN	43	44	43	44	43	44
	D	44	45	44	45	44	45
	C	44	46	44	46	44	46
	All	44	45	44	45	44	45
Mar	W	47	48	47	48	46	48
	AN	48	49	48	49	48	49
	BN	47	48	47	49	47	48
	D	49	50	49	50	49	50
	C	49	50	49	50	49	50
	All	48	49	48	49	48	49
Apr	W	50	51	50	51	50	51
	AN	51	52	52	52	51	52
	BN	52	53	52	53	51	53
	D	52	53	52	53	52	53
	C	51	52	51	52	51	53
	All	51	52	51	52	51	52
May	W	47	48	47	48	47	48
	AN	47	48	47	48	47	48
	BN	48	49	48	49	48	49
	D	48	49	48	49	48	49
	C	51	52	51	53	51	52
	All	48	49	48	49	48	49
Jun	W	49	51	49	51	49	51
	AN	51	52	51	52	51	52
	BN	52	53	52	53	52	53
	D	52	54	53	54	53	55
	C	58	59	57	60	58	59
	All	52	53	52	53	52	53
Jul	W	53	54	53	54	53	54
	AN	52	52	52	53	52	52
	BN	53	55	53	55	53	54
	D	52	53	52	54	52	53
	C	56	61	55	59	55	60
	All	53	55	53	55	53	55

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Aug	W	52	54	52	54	52	54
	AN	51	53	51	52	51	53
	BN	53	55	53	55	53	55
	D	52	55	52	54	52	55
	C	59	64	57	62	58	63
	All	53	56	53	55	53	55
Sep	W	50	51	50	51	50	52
	AN	50	52	50	51	50	52
	BN	53	55	53	55	53	55
	D	53	56	53	56	53	56
	C	60	63	58	62	60	62
	All	52	55	52	54	53	55
Oct	W	49	51	49	51	50	51
	AN	50	52	51	52	51	52
	BN	52	53	52	53	52	53
	D	50	52	50	52	50	52
	C	53	55	53	55	53	55
	All	51	52	51	52	51	52
Nov	W	45	47	45	47	45	47
	AN	45	47	46	47	46	47
	BN	46	48	46	47	46	48
	D	45	47	45	47	45	47
	C	47	48	47	48	47	48
	All	46	47	46	47	46	47
Dec	W	42	43	42	43	42	43
	AN	40	43	40	43	40	43
	BN	40	42	40	42	40	42
	D	41	42	41	42	41	42
	C	40	41	40	41	40	41
	All	41	42	41	42	41	42

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-104. Differences[a] between ESO Scenarios and HOS and LOS Scenarios in Mean Monthly Water Temperature (°F) in the Trinity River below Lewiston Dam

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	-0.05 (-0.1%)	0 (0%)	0.03 (0.1%)	0 (0%)
	AN	0 (0%)	-0.4 (-1%)	-0.1 (-0.3%)	0.1 (0.2%)
	BN	0.04 (0.1%)	0 (0%)	0.1 (0.3%)	-0.1 (-0.2%)
	D	-0.2 (-0.5%)	-1 (-1.6%)	-0.1 (-0.2%)	-0.3 (-0.7%)
	C	-0.02 (-0.1%)	-0.1 (-0.3%)	0.03 (0.1%)	0.05 (0.1%)
	All	-0.1 (-0.2%)	-0.2 (-0.5%)	0 (0%)	-0.1 (-0.1%)
Feb	W	0 (0%)	0.03 (0.1%)	0 (0%)	0 (0%)
	AN	0 (0%)	0.04 (0.1%)	-0.1 (-0.1%)	0.1 (0.2%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0.03 (0.1%)	0.03 (0.1%)	0.1 (0.1%)
	C	0 (0%)	0 (0%)	-0.2 (-0.4%)	0 (0%)
	All	0 (0%)	0 (0%)	-0.02 (-0.1%)	0 (0%)
Mar	W	0 (0%)	0 (0%)	-0.1 (-0.3%)	-0.1 (-0.3%)
	AN	0.1 (0.3%)	0 (-0.1%)	-0.1 (-0.1%)	0 (0%)
	BN	0 (0%)	0.4 (0.9%)	0 (0%)	-0.1 (-0.3%)
	D	0.05 (0.1%)	0.1 (0.2%)	0 (0%)	0.1 (0.3%)
	C	0.1 (0.1%)	0 (0%)	0 (0%)	0 (0%)
	All	0.04 (0.1%)	0.1 (0.2%)	-0.1 (-0.1%)	-0.03 (-0.1%)
Apr	W	0 (0%)	0.2 (0.3%)	-0.1 (-0.2%)	-0.4 (-0.8%)
	AN	0.5 (0.9%)	-0.4 (-0.8%)	0.1 (0.2%)	-0.1 (-0.1%)
	BN	-0.3 (-0.6%)	0.1 (0.2%)	-1 (-1.5%)	0 (0%)
	D	0 (0%)	-0.1 (-0.1%)	-0.1 (-0.1%)	-0.03 (-0.1%)
	C	0.2 (0.3%)	0.1 (0.3%)	-0.2 (-0.4%)	0.2 (0.4%)
	All	0.03 (0.1%)	0 (0%)	-0.2 (-0.4%)	-0.1 (-0.2%)
May	W	0 (0%)	-0.03 (-0.1%)	0 (0%)	0 (0%)
	AN	-0.2 (-0.3%)	0 (0%)	0 (0%)	0 (0%)
	BN	0.04 (0.1%)	0.1 (0.1%)	0 (-0.1%)	0.03 (0.1%)
	D	0 (0%)	0 (0%)	0.1 (0.1%)	0.1 (0.1%)
	C	-0.2 (-0.3%)	0.2 (0.4%)	-0.1 (-0.2%)	0 (0%)
	All	0 (-0.1%)	0.03 (0.1%)	0 (0%)	0 (0%)
Jun	W	0 (0%)	0.1 (0.1%)	0 (0%)	0.04 (0.1%)
	AN	-0.3 (-0.6%)	0 (0%)	0 (0%)	0 (0%)
	BN	-0.2 (-0.4%)	0.2 (0.5%)	-0.2 (-0.4%)	0.1 (0.3%)
	D	1 (1.3%)	-0.1 (-0.3%)	1 (1.9%)	0.1 (0.2%)
	C	-1 (-1%)	1 (2.1%)	-0.2 (-0.4%)	0.2 (0.3%)
	All	0 (0%)	0.2 (0.4%)	0.1 (0.3%)	0.1 (0.2%)
Jul	W	-0.2 (-0.3%)	0.1 (0.1%)	-0.05 (-0.1%)	0 (0%)
	AN	0.3 (0.6%)	1 (1.7%)	0 (0%)	0 (0%)
	BN	0.2 (0.4%)	0.4 (0.8%)	0 (0%)	-0.3 (-0.5%)
	D	0 (0%)	0.2 (0.4%)	0.1 (0.3%)	-0.1 (-0.2%)
	C	-1 (-1.2%)	-1 (-2%)	-1 (-0.9%)	-0.2 (-0.3%)
	All	-0.1 (-0.1%)	0.1 (0.2%)	-0.1 (-0.1%)	-0.1 (-0.2%)

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	0 (0%)	0.1 (0.1%)	0 (0%)	0 (0%)
	AN	0.05 (0.1%)	-0.4 (-0.8%)	0.1 (0.1%)	0 (0%)
	BN	0.1 (0.2%)	-0.3 (-0.5%)	0 (0%)	-0.04 (-0.1%)
	D	-0.3 (-0.6%)	-1 (-1.4%)	-0.2 (-0.3%)	-0.5 (-0.9%)
	C	-2 (-2.8%)	-2 (-3%)	-0.5 (-0.8%)	-0.4 (-0.6%)
	All	-0.3 (-0.6%)	-1 (-1%)	-0.1 (-0.2%)	-0.2 (-0.3%)
Sep	W	-0.1 (-0.1%)	-0.03 (-0.1%)	0.2 (0.4%)	1 (1.2%)
	AN	-0.5 (-1%)	-0.4 (-0.7%)	0 (0%)	0 (0%)
	BN	-0.1 (-0.2%)	-0.1 (-0.2%)	0.1 (0.1%)	0 (0%)
	D	-0.1 (-0.1%)	-1 (-1.5%)	-0.03 (-0.1%)	-1 (-1.3%)
	C	-2 (-2.5%)	-1 (-1.9%)	0.2 (0.4%)	-1 (-1.4%)
	All	-0.3 (-0.7%)	-0.4 (-0.8%)	0.1 (0.2%)	-0.1 (-0.2%)
Oct	W	-0.03 (-0.1%)	0 (-0.1%)	0.2 (0.4%)	0.3 (0.6%)
	AN	1 (1.2%)	-0.3 (-0.5%)	1 (1.1%)	0 (0%)
	BN	-0.1 (-0.1%)	-0.2 (-0.3%)	0.1 (0.2%)	0 (0%)
	D	0.1 (0.1%)	-1 (-1.1%)	0.2 (0.4%)	-0.4 (-0.7%)
	C	-0.4 (-0.7%)	0.3 (0.5%)	-0.4 (-0.8%)	-0.4 (-0.8%)
	All	0 (0%)	-0.2 (-0.3%)	0.1 (0.3%)	-0.1 (-0.1%)
Nov	W	0 (0%)	0.1 (0.2%)	0 (-0.1%)	0.2 (0.3%)
	AN	0.1 (0.2%)	0 (0%)	0.2 (0.4%)	0 (0%)
	BN	-0.1 (-0.3%)	-0.4 (-0.8%)	-0.1 (-0.2%)	-0.3 (-0.7%)
	D	0.03 (0.1%)	-0.1 (-0.2%)	-0.1 (-0.2%)	-0.3 (-0.5%)
	C	-0.4 (-0.9%)	0.2 (0.4%)	-0.5 (-1%)	0.2 (0.4%)
	All	-0.1 (-0.2%)	-0.03 (-0.1%)	-0.1 (-0.2%)	-0.04 (-0.1%)
Dec	W	-0.1 (-0.2%)	0.05 (0.1%)	0.1 (0.3%)	-0.1 (-0.2%)
	AN	0.2 (0.4%)	0.1 (0.1%)	-0.1 (-0.2%)	-0.1 (-0.2%)
	BN	-0.04 (-0.1%)	0.04 (0.1%)	-0.3 (-0.7%)	-0.3 (-0.6%)
	D	0.03 (0.1%)	-0.1 (-0.1%)	0.2 (0.5%)	-0.2 (-0.4%)
	C	0.2 (0.5%)	0.1 (0.1%)	0.03 (0.1%)	0.3 (0.7%)
	All	0.03 (0.1%)	0.03 (0.1%)	0.02 (0.1%)	-0.1 (-0.2%)

[a] Positive values indicate higher temperatures under HOS or LOS than under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-105. Mean Monthly Water Temperature (°F) in the Trinity River at North Fork for ESO, HOS, and LOS Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	40	41	40	41	40	41
	AN	39	39	39	39	39	40
	BN	38	39	38	39	39	39
	D	38	39	38	39	38	39
	C	39	40	39	40	39	40
	All	39	40	39	40	39	40
Feb	W	44	44	44	44	44	44
	AN	44	44	44	44	44	44
	BN	43	44	43	44	43	44
	D	43	44	43	44	43	44
	C	44	45	44	45	44	45
	All	44	44	44	44	44	44
Mar	W	46	47	46	47	46	47
	AN	47	47	47	47	47	47
	BN	47	47	47	47	47	47
	D	47	48	47	48	47	48
	C	48	49	48	49	48	49
	All	47	47	47	47	47	47
Apr	W	53	53	53	53	53	53
	AN	54	55	54	55	54	55
	BN	54	55	54	55	54	55
	D	54	55	54	55	54	55
	C	55	55	55	55	55	55
	All	54	55	54	55	54	54
May	W	51	52	51	52	51	52
	AN	51	52	51	52	51	52
	BN	52	53	52	53	52	53
	D	53	54	53	54	53	54
	C	56	57	56	57	56	57
	All	52	53	52	53	52	53
Jun	W	56	57	56	57	56	57
	AN	58	58	58	58	58	58
	BN	60	61	60	61	60	61
	D	62	64	62	64	63	64
	C	65	66	64	66	65	66
	All	60	61	60	61	60	61
Jul	W	64	66	64	66	64	66
	AN	64	65	64	66	64	65
	BN	65	67	65	67	65	67
	D	66	68	66	68	66	68
	C	69	71	69	71	69	71
	All	66	67	66	67	66	67

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Aug	W	66	67	66	67	66	67
	AN	65	67	65	67	65	67
	BN	66	68	66	68	66	68
	D	65	67	65	67	65	67
	C	67	70	67	69	67	70
	All	66	68	66	68	66	68
Sep	W	60	62	60	62	60	62
	AN	60	61	60	61	60	61
	BN	61	63	61	63	61	63
	D	60	62	60	62	60	62
	C	63	64	62	63	62	64
	All	61	62	60	62	61	62
Oct	W	54	55	54	55	54	55
	AN	54	55	54	55	54	55
	BN	55	56	55	56	55	56
	D	53	55	53	54	54	54
	C	55	56	55	56	55	56
	All	54	55	54	55	54	55
Nov	W	44	45	44	45	44	45
	AN	45	46	45	46	45	46
	BN	45	46	45	46	45	46
	D	44	45	44	45	44	45
	C	46	47	46	47	46	47
	All	45	46	45	46	45	46
Dec	W	41	42	41	42	41	42
	AN	41	41	41	41	41	41
	BN	40	41	40	41	40	41
	D	40	41	40	41	40	41
	C	39	40	39	40	39	40
	All	40	41	40	41	40	41

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-106. Differences[a] between ESO Scenarios and HOS and LOS Scenarios in Mean Monthly Water Temperature (°F) in the Trinity River at North Fork

		Scenarios[c]			
Month	Water-Year Type[b]	ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	-0.03 (-0.1%)	0 (0%)	0 (0%)	0.02 (0.1%)
	AN	0 (0%)	-0.1 (-0.1%)	0.1 (0.2%)	0.2 (0.5%)
	BN	0 (0%)	0 (0%)	0.2 (0.5%)	-0.02 (-0.1%)
	D	-0.04 (-0.1%)	-0.2 (-0.4%)	0 (0%)	-0.1 (-0.1%)
	C	0 (0%)	0 (0%)	0 (0%)	0.03 (0.1%)
	All	-0.02 (-0.1%)	-0.04 (-0.1%)	0.05 (0.1%)	0 (0%)
Feb	W	0 (0%)	0.02 (0.1%)	0 (0%)	0.02 (0.1%)
	AN	0 (0%)	-0.05 (-0.1%)	0 (0%)	0.05 (0.1%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	-0.02 (-0.1%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0.03 (0.1%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	W	0 (0%)	0 (0%)	-0.03 (-0.1%)	-0.1 (-0.1%)
	AN	0.1 (0.1%)	-0.1 (-0.1%)	0 (0%)	0 (0%)
	BN	-0.1 (-0.1%)	0 (0%)	-0.1 (-0.2%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0.05 (0.1%)	0.03 (0.1%)	0 (0%)	0.1 (0.1%)
	All	0 (0%)	0 (0%)	-0.03 (-0.1%)	0 (0%)
May	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	-0.1 (-0.2%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0.04 (0.1%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0.03 (0.1%)	0.03 (0.1%)
	C	-0.1 (-0.2%)	0.1 (0.2%)	-0.1 (-0.1%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	W	0 (0%)	0.04 (0.1%)	0 (0%)	0 (0%)
	AN	-0.2 (-0.3%)	0 (0%)	0 (0%)	0 (0%)
	BN	-0.1 (-0.2%)	0.1 (0.2%)	-0.1 (-0.2%)	0.1 (0.1%)
	D	0.2 (0.4%)	-0.1 (-0.1%)	0.3 (0.5%)	0 (0%)
	C	-0.2 (-0.3%)	0.4 (0.6%)	-0.1 (-0.1%)	0.1 (0.1%)
	All	0 (0%)	0.1 (0.1%)	0.04 (0.1%)	0 (0%)
Jul	W	-0.1 (-0.1%)	0 (0%)	0 (0%)	0 (0%)
	AN	0.1 (0.2%)	0.4 (0.6%)	0 (0%)	0 (0%)
	BN	0.1 (0.1%)	0.2 (0.2%)	0 (0%)	-0.1 (-0.2%)
	D	0 (0%)	0.04 (0.1%)	0 (0%)	-0.1 (-0.1%)
	C	-0.2 (-0.2%)	-0.3 (-0.4%)	-0.1 (-0.2%)	-0.05 (-0.1%)
	All	0 (0%)	0.1 (0.1%)	0 (0%)	-0.04 (-0.1%)

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	-0.1 (-0.2%)	0 (0%)	0 (0%)
	BN	0 (0%)	-0.1 (-0.1%)	0 (0%)	0 (0%)
	D	-0.1 (-0.1%)	-0.2 (-0.3%)	-0.04 (-0.1%)	-0.1 (-0.2%)
	C	-0.4 (-0.7%)	-1 (-1%)	-0.1 (-0.2%)	-0.1 (-0.1%)
	All	-0.1 (-0.1%)	-0.2 (-0.2%)	0 (0%)	-0.04 (-0.1%)
Sep	W	0 (0%)	0 (0%)	0.05 (0.1%)	0.2 (0.3%)
	AN	-0.1 (-0.2%)	-0.1 (-0.2%)	0 (0%)	0 (0%)
	BN	0 (0%)	-0.04 (-0.1%)	0 (0%)	0 (0%)
	D	0 (0%)	-0.3 (-0.4%)	0 (0%)	-0.2 (-0.3%)
	C	-1 (-1.1%)	-0.2 (-0.4%)	-0.2 (-0.4%)	0.3 (0.5%)
	All	-0.1 (-0.2%)	-0.1 (-0.2%)	0 (0%)	0.1 (0.1%)
Oct	W	0 (0%)	0 (0%)	0.04 (0.1%)	0.1 (0.1%)
	AN	-0.1 (-0.1%)	-0.05 (-0.1%)	0 (0%)	0 (0%)
	BN	0 (0%)	-0.1 (-0.1%)	0 (0%)	0 (0%)
	D	-0.1 (-0.1%)	-0.2 (-0.3%)	0.05 (0.1%)	-0.1 (-0.2%)
	C	-0.1 (-0.1%)	0 (0%)	-0.1 (-0.2%)	-0.1 (-0.2%)
	All	-0.04 (-0.1%)	-0.1 (-0.1%)	0 (0%)	0 (0%)
Nov	W	0 (0%)	0 (0%)	0 (0%)	0.03 (0.1%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	-0.04 (-0.1%)	-0.1 (-0.2%)	-0.03 (-0.1%)	-0.1 (-0.2%)
	D	0 (0%)	0 (0%)	0 (0%)	-0.1 (-0.1%)
	C	-0.1 (-0.3%)	0.1 (0.1%)	-0.1 (-0.3%)	0.04 (0.1%)
	All	0 (0%)	0 (0%)	-0.02 (-0.1%)	0 (0%)
Dec	W	0 (0%)	0.03 (0.1%)	0.03 (0.1%)	0.1 (0.3%)
	AN	0.03 (0.1%)	0 (0%)	0 (0%)	-0.04 (-0.1%)
	BN	-0.02 (-0.1%)	0 (0%)	-0.1 (-0.2%)	-0.1 (-0.1%)
	D	0 (0%)	-0.03 (-0.1%)	0.1 (0.2%)	-0.03 (-0.1%)
	C	0.1 (0.1%)	0.1 (0.2%)	0 (0%)	0.1 (0.2%)
	All	0 (0%)	0 (0%)	0 (0%)	0.04 (0.1%)

[a] Positive values indicate higher water temperatures under HOS or LOS than under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Redd Dewatering

To determine the effects of the ESO on redd dewatering risk to Pacific and river lamprey in the Trinity River, the number and frequency of redd "cohorts" experiencing a month-over-month (from one month to the next) decrease in flow of greater than 50%, which is assumed here to represent a redd dewatering event, below Lewiston Dam was determined from CALSIM model outputs. Small-scale spawning location suitability characteristics (e.g., depth, velocity, and substrate) is not adequately for lamprey described to enable a more formal analysis, such as a weighted usable area analysis. Therefore, the change in month-over-month flows was used as a surrogate a month-over-month flow reduction of 50% was chosen as a best professional estimate of conditions in which redd dewatering is expected to occur, but this value does not estimate empirically-derived redd dewatering events. A "cohort" of eggs was assumed to be "born" every month during either January through August for Pacific lamprey or February through June for river lamprey. Because HOS and LOS flows in the Trinity River would generally be similar to flows under ESO, no further analyses of redd dewatering risk were conducted for these model scenarios.

Results of the dewatering risk for Pacific lamprey are presented in Table 5C.5.2-91 and differences between pairs of model scenarios in redd dewatering risk are presented in Table 5C.5.2-92. The total number of redd cohorts below Lewiston Dam that would experience a 50% month-over-month flow decrease would be similar between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. Therefore, there would be no effect of the ESO on Pacific lamprey redd dewatering risk in the Trinity River.

Results of the dewatering risk for river lamprey are presented in Table 5C.5.2-93 and differences between pairs of model scenarios in redd dewatering risk are presented in Table 5C.5.2-94. The total number of redd cohorts that would experience a 50% month-over-month flow decrease would be identical between the EBC2_ELT and ESO_ELT and similar between EBC2_LLT and ESO_LLT, These results indicate that there would be no effect of the ESO on river lamprey redd dewatering risk in the Trinity River.

Because neither the exact locations of Pacific and river lamprey redds nor flow-WUA relationships for Pacific and river lamprey were used in this analysis, these results represent a relative estimate of redd dewatering among model scenarios. Therefore, there is low certainty in these conclusions.

5C.5.2.2.1.2 Ammocoete

Water Temperature

For Pacific lamprey, water temperatures above 22°C (71.6°F) may cause significant death (~50%) or deformation of eggs and ammocoetes (Meeuwig et al. 2005). For river lamprey, no specific water temperature thresholds for ammocoetes have been established. Therefore, either 71.6°F, the Pacific lamprey ammocoete threshold, or 77°F, the river lamprey egg temperature threshold could be used to determine effects. As indicated above, in the Trinity River below Lewiston Dam and at North Fork, there are no differences in water temperatures between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT (Table 5C.5.2-99, Table 5C.5.2-100, Table 5C.5.2-101, Table 5C.5.2-102). Further, year-round water temperatures in the Trinity River at North Fork and Lewiston Dam under HOS and LOS would not be different from those under the ESO (Table 5C.5.2-103, Table 5C.5.2-104, Table 5C.5.2-105, Table 5C.5.2-106). Therefore, it was concluded with low certainty that there are no temperature-related effects of ESO, HOS, and LOS scenarios on Pacific or river lamprey ammocoetes in the Trinity River. As a result, no further temperature analyses were conducted for lamprey ammocoetes in the Trinity River.

Stranding

To determine the effects of the ESO on ammocoete stranding risk to Pacific and river lamprey in the Trinity River, the number and frequency of ammocoete "cohorts" experiencing a month-over-month decrease in flow ranging from greater than 50% to greater than 90% below Lewiston Dam was determined from CALSIM model outputs. The range of flow reductions was 50–90% (in 5% increments) and included the range in which model scenarios were distinguishable and indistinguishable from one another. For Pacific lamprey, a "cohort" of ammocoetes was assumed to be "born" every month during their spawning period (January–August) and spend five years rearing upstream. For river lamprey, cohorts were assumed to be born every month during February through June and spend five years rearing upstream. A cohort was considered "stranded" if at least one month-over-month flow reduction was greater than the each flow reduction at any time during the seven-year (for Pacific lamprey) or five-year rearing period (for river lamprey). Because HOS and LOS flows do not differ meaningfully from ESO flows, no further analyses of stranding risk were conducted for these model scenarios.

The number of Pacific lamprey ammocoete cohorts that may be stranded by month-over-month flow reductions in the Trinity River at Lewiston is presented in Figure 5C.5.2-82 and differences between model scenarios are presented in Table 5C.5.2-107. Differences in the number of Pacific lamprey ammocoetes exposed to flow reductions between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT are predicted to generally be negligible for all flow reductions examined, except in the ELT at the 90% flow reduction (5% higher under ESO_ELT). These results indicate that there are generally no effects of flow reductions under the ESO on Pacific lamprey stranding risk. The majority of differences between model scenarios would be due to climate change.

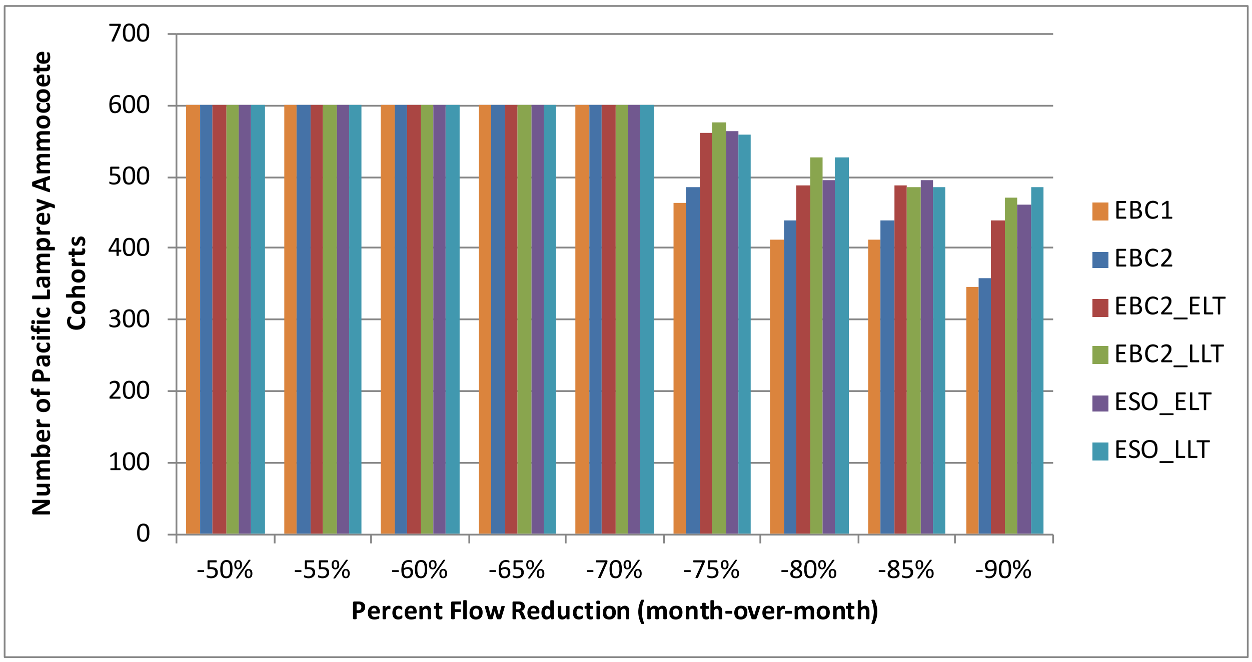


Figure 5C.5.2-82. Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions of 50% to 90%, Trinity River below Lewiston Dam, under EBC and ESO Scenarios

Table 5C.5.2-107. Differences between EBC and ESO Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Trinity River below Lewiston Dam

Flow Reduction	Percent Difference [a] between Scenarios [b]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
50%	0	0	0	0	0	0
55%	0	0	0	0	0	0
60%	0	0	0	0	0	0
65%	0	0	0	0	0	0
70%	0	0	0	0	0	0
75%	22	21	16	15	1	-3
80%	20	27	13	20	1	0
85%	20	18	13	10	1	0
90%	34	40	29	35	5	3

[a] Positive values indicate increased cohort exposureunder the ESO.
[b] See Table 5C.0-1 for definitions of the scenarios.

The number of river lamprey ammocoete cohorts that may be stranded by month-over-month flow reductions in the Trinity River at Lewiston is presented in, Figure 5C.5.2-83 and differences between model scenarios are presented in Table 5C.5.2-108. Differences in the number of river lamprey ammocoetes exposed to flow reductions between EBC2_ELT and ESO_ELT are predicted to generally be negligible for the 50% to 75% flow reductions range. For the 80% to 90% flow reduction range, ammocoete stranding risk would be 5% to 11% higher under the ESO_ELT than EBC2_ELT. It is not likely that this increase would have a biologically meaningful effect on river lamprey ammocoetes, as it would consist of an increase of only 24 out of 385 possible cohorts. Differences in ammocoete stranding risk between EBC2_ELT and ESO_ELT are predicted to generally be negligible for the entire flow reduction range, except at the 75% flow reduction (5% lower under ESO_LLT). This 5% reduction stranding risk is not expected to have a biologically meaningful effect on river lamprey. Overall, these results indicate that there are generally no effects of flow reductions under the ESO on river lamprey stranding risk. The majority of differences between model scenarios would be due to climate change.

These results indicate that, overall, in both the early long-term and late long-term, Pacific and river lamprey ammocoetes are predicted to be exposed to flow reductions under the ESO in the Trinity River at generally the same frequency as under existing biological conditions, with few exceptions. The majority of differences between model scenarios would be due to climate change.

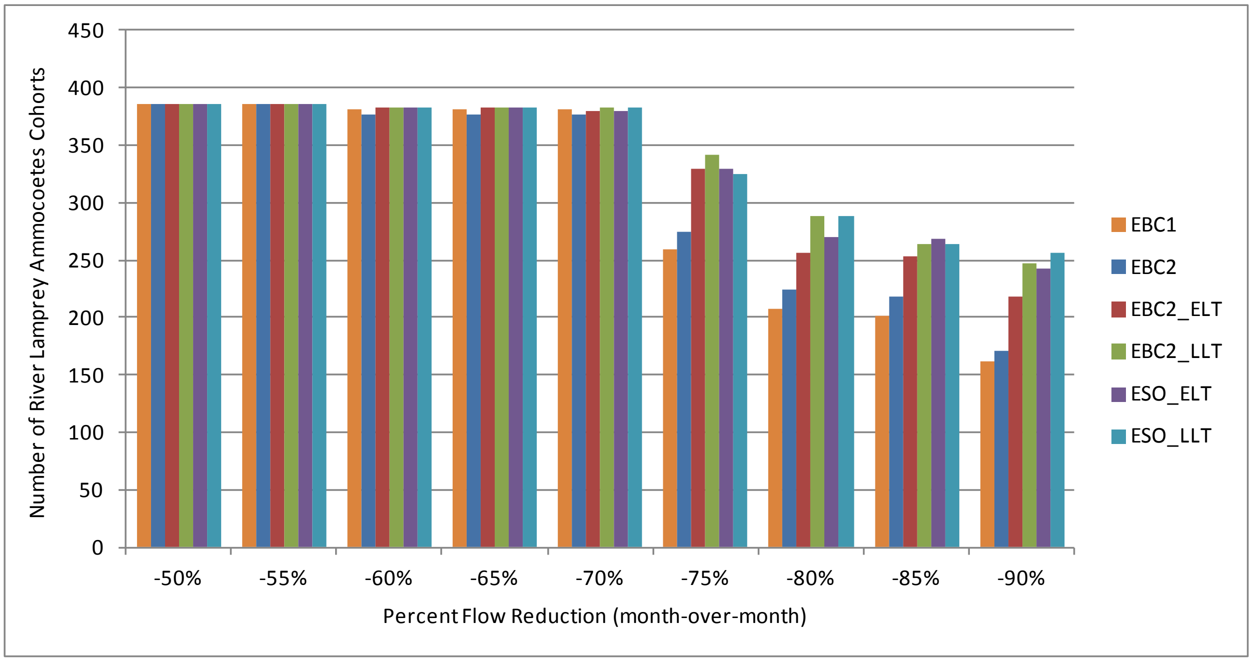


Figure 5C.5.2-83. Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions of 50% to 90%, Trinity River below Lewiston Dam, under EBC and ESO Scenarios

Table 5C.5.2-108. Differences between EBC and ESO Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Trinity River below Lewiston Dam

Flow Reduction	Percent Difference[a] between Scenarios[b]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
50%	0	0	0	0	0	0
55%	0	0	0	0	0	0
60%	0	0	1	1	0	0
65%	0	0	1	1	0	0
70%	0	0	1	1	0	0
75%	27	25	20	19	0	-5
80%	30	39	20	28	5	0
85%	33	31	22	21	6	0
90%	49	59	42	50	11	4

[a] Positive values indicate increased cohort exposure under the ESO.
[b] See Table 5C.0-1 for definitions of the scenarios.

5C.5.2.3 Clear Creek

5C.5.2.3.1 Steelhead

5C.5.2.3.1.1 Eggs and Alevins

Upstream Spawning Habitat

The primary spawning and egg incubation period is January through April. Monthly mean flows by water-year type in Clear Creek below Whiskeytown are presented in Table 5C.5.2-109 and differences between pairs of model scenarios are presented in Table 5C.5.2-110. Monthly frequency of exceedance plots for Clear Creek flows are presented in Figure 5C.5.2-84 through Figure 5C.5.2-95. Exceedance plots specific to the January through April steelhead spawning and egg incubation period are presented in Figure 5C.5.2-84 through Figure 5C.5.2-87. These results indicate that there would be no differences in mean flows between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT regardless of month and water-year type, except for a 7% increase in flows under the ESO_LLT in critical water years during January. This increase in flows is not expected to have a biologically meaningful effect on steelhead spawning or egg incubation because it is small and infrequent. Climate change effects are generally limited to wet water years during January through March and would be beneficial (increase in flows through time).

Flows under HOS and LOS scenarios are presented in Table 5C.5.2-111 and differences between the ESO scenario and HOS and LOS scenarios are presented in Table 5C.5.2-112. Flows under HOS and LOS are generally similar to flows with few exceptions in which differences from ESO would be infrequent and of small magnitude. Therefore, there would generally be no differences in Clear Creek flows between the ESO scenario and HOS and LOS scenarios. As a result, consistent with the ESO, there would be no effects of HOS and LOS scenarios on steelhead spawning and egg incubation habitat.

1 **Table 5C.5.2-109. Mean Monthly Flows (cfs) in Clear Creek below Whiskeytown during the Year-Round**
2 **Juvenile Steelhead Rearing Period under EBC and ESO Scenarios**

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	220	220	309	339	309	339
	AN	192	192	192	192	192	192
	BN	189	189	189	189	189	189
	D	184	192	192	192	192	192
	C	155	168	166	159	171	171
	All	193	197	225	233	225	235
Feb	W	220	220	249	257	249	257
	AN	197	196	196	196	196	196
	BN	189	189	189	189	189	189
	D	184	192	192	192	192	192
	C	155	168	166	168	171	171
	All	194	197	206	209	207	210
Mar	W	200	200	207	259	207	258
	AN	197	205	203	196	196	196
	BN	189	189	192	202	189	201
	D	186	192	192	192	192	192
	C	155	168	166	168	171	171
	All	188	193	194	212	194	212
Apr	W	200	200	200	200	200	200
	AN	197	196	196	196	196	196
	BN	189	189	192	189	189	189
	D	188	192	192	192	192	192
	C	155	168	166	168	171	171
	All	189	191	191	191	191	191
May	W	277	277	277	277	277	277
	AN	277	277	277	277	277	277
	BN	263	269	269	269	269	269
	D	264	264	264	264	264	264
	C	211	224	224	224	224	224
	All	262	265	265	265	265	265
Jun	W	200	200	200	200	200	200
	AN	200	200	200	200	200	200
	BN	181	186	186	186	186	186
	D	180	180	180	180	180	180
	C	115	120	120	131	120	120
	All	180	181	181	183	181	181
Jul	W	85	85	85	85	85	85
	AN	85	85	85	85	85	85
	BN	85	85	85	85	85	85
	D	85	85	85	85	85	85
	C	85	85	99	85	85	85
	All	85	85	87	85	85	85

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Aug	W	85	85	85	85	85	85
	AN	85	85	85	85	85	85
	BN	85	85	85	85	85	85
	D	85	85	85	85	85	85
	C	94	94	85	71	94	71
	All	86	86	85	83	86	83
Sep	W	150	150	150	150	150	150
	AN	150	150	150	150	150	150
	BN	150	150	150	150	150	150
	D	144	150	150	150	150	150
	C	133	133	121	96	108	96
	All	146	148	146	142	144	142
Oct	W	198	198	198	198	198	198
	AN	183	183	183	183	183	183
	BN	189	179	179	182	179	189
	D	175	183	183	183	175	180
	C	150	167	165	142	154	142
	All	182	185	185	182	181	182
Nov	W	198	198	198	198	198	198
	AN	185	185	180	182	180	182
	BN	184	189	189	189	189	189
	D	177	184	184	177	176	177
	C	155	168	158	145	158	158
	All	183	187	185	182	183	184
Dec	W	198	198	198	198	198	198
	AN	185	192	192	192	192	192
	BN	189	189	189	189	189	189
	D	177	189	189	189	189	189
	C	155	168	166	156	171	171
	All	184	189	189	187	190	190

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-110. Differences[a] between EBC and ESO Scenarios in Mean Monthly Flows (cfs) in Clear Creek below Whiskeytown

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	88 (40.1%)	118 (53.6%)	88 (40.1%)	118 (53.6%)	0 (0%)	-0.2 (-0.1%)
	AN	-0.2 (-0.1%)	-0.2 (-0.1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	7 (3.9%)	7 (3.9%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	16 (10.2%)	16 (10.2%)	3 (1.5%)	2 (1.5%)	5 (2.9%)	12 (7.4%)
	All	32 (16.5%)	41 (21.4%)	28 (14.4%)	38 (19.2%)	1 (0.3%)	2 (0.7%)
Feb	W	29 (13.3%)	38 (17.1%)	29 (13.3%)	38 (17.1%)	0 (0%)	-0.2 (-0.1%)
	AN	-1 (-0.4%)	-1 (-0.4%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	7 (3.9%)	7 (3.9%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	16 (10.2%)	16 (10.2%)	3 (1.5%)	2 (1.5%)	5 (2.9%)	3 (1.7%)
	All	13 (6.7%)	16 (8.1%)	10 (4.9%)	12 (6.2%)	1 (0.3%)	0.3 (0.2%)
Mar	W	7 (3.3%)	58 (29.2%)	7 (3.3%)	58 (29.1%)	0 (0%)	-0.2 (-0.1%)
	AN	-1 (-0.4%)	-1 (-0.4%)	-10 (-4.6%)	-10 (-4.6%)	-7 (-3.7%)	0 (0%)
	BN	0 (0%)	12 (6.1%)	0 (0%)	12 (6.1%)	-3 (-1.4%)	-1 (-0.4%)
	D	6 (3.2%)	6 (3.2%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	16 (10.2%)	16 (10.2%)	3 (1.5%)	2 (1.5%)	5 (2.9%)	3 (1.7%)
	All	6 (3%)	24 (12.8%)	1 (0.5%)	19 (10.1%)	-1 (-0.4%)	0.2 (0.1%)
Apr	W	0 (0%)	0 (0%)	0 (-0.1%)	-0.1 (-0.1%)	0 (0%)	-0.2 (-0.1%)
	AN	-1 (-0.4%)	-1 (-0.4%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	-3 (-1.4%)	0 (0%)
	D	3 (1.7%)	3 (1.7%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	16 (10.2%)	16 (10.2%)	3 (1.5%)	2 (1.5%)	5 (2.9%)	3 (1.7%)
	All	3 (1.5%)	3 (1.5%)	0.3 (0.2%)	0.3 (0.2%)	0.2 (0.1%)	0.3 (0.2%)
May	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	6 (2.2%)	6 (2.2%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	13 (6.2%)	13 (6.2%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	3 (1.1%)	3 (1.1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	5 (2.6%)	5 (2.6%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	5 (4.7%)	5 (4.7%)	0 (0%)	0 (0%)	0 (0%)	-11 (-8.2%)
	All	2 (0.9%)	2 (0.9%)	0 (0%)	0 (0%)	0 (0%)	-2 (-0.9%)
Jul	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)	-14 (-13.8%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)	-2 (-2.3%)	0 (0%)

Month	Water-Year Type[b]	Scenarios[c] EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Aug	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	-0.3 (-0.3%)	-23 (-24.9%)	-0.3 (-0.3%)	-23 (-24.9%)	9 (10.6%)	0 (0%)
	All	0 (0%)	-3 (-4%)	0 (0%)	-3 (-4%)	1 (1.6%)	0 (0%)
Sep	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	6 (3.8%)	6 (3.8%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	-25 (-18.7%)	-37 (-28.1%)	-25 (-18.7%)	-37 (-28.1%)	-13 (-10.3%)	0 (0%)
	All	-2 (-1.7%)	-4 (-2.9%)	-4 (-2.5%)	-5 (-3.7%)	-2 (-1.3%)	0 (0%)
Oct	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	-11 (-5.7%)	0 (0%)	0 (0%)	11 (6%)	0 (0%)	7 (4.1%)
	D	0 (0%)	5 (2.8%)	-8 (-4.5%)	-3 (-1.9%)	-8 (-4.5%)	-3 (-1.9%)
	C	4 (2.8%)	-8 (-5.6%)	-13 (-7.5%)	-25 (-15%)	-11 (-6.5%)	0 (0%)
	All	-1 (-0.7%)	-0.1 (-0.1%)	-4 (-2%)	-3 (-1.4%)	-3 (-1.8%)	1 (0.3%)
Nov	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	-5 (-2.8%)	-3 (-1.8%)	-5 (-2.7%)	-3 (-1.7%)	0 (0%)	0 (0%)
	BN	6 (3.1%)	6 (3.1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	-1 (-0.6%)	-1 (-0.3%)	-8 (-4.5%)	-8 (-4.2%)	-8 (-4.5%)	0.1 (0.1%)
	C	3 (2.2%)	3 (1.9%)	-10 (-5.9%)	-10 (-6.2%)	0 (0%)	12 (8.6%)
	All	0.5 (0.3%)	1 (0.4%)	-4 (-2.1%)	-4 (-2%)	-2 (-1%)	2 (1%)
Dec	W	0 (0%)	0 (0%)	-0.1 (-0.1%)	-0.1 (-0.1%)	-0.1 (-0.1%)	0 (0%)
	AN	7 (3.6%)	7 (3.6%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	12 (6.6%)	12 (6.6%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	16 (10.2%)	16 (10.2%)	3 (1.5%)	2 (1.5%)	5 (2.9%)	15 (9.7%)
	All	6 (3.2%)	6 (3.2%)	0.3 (0.2%)	0.3 (0.2%)	1 (0.4%)	2 (1.2%)

[a] Positive values indicate greater flow under ESO than under EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

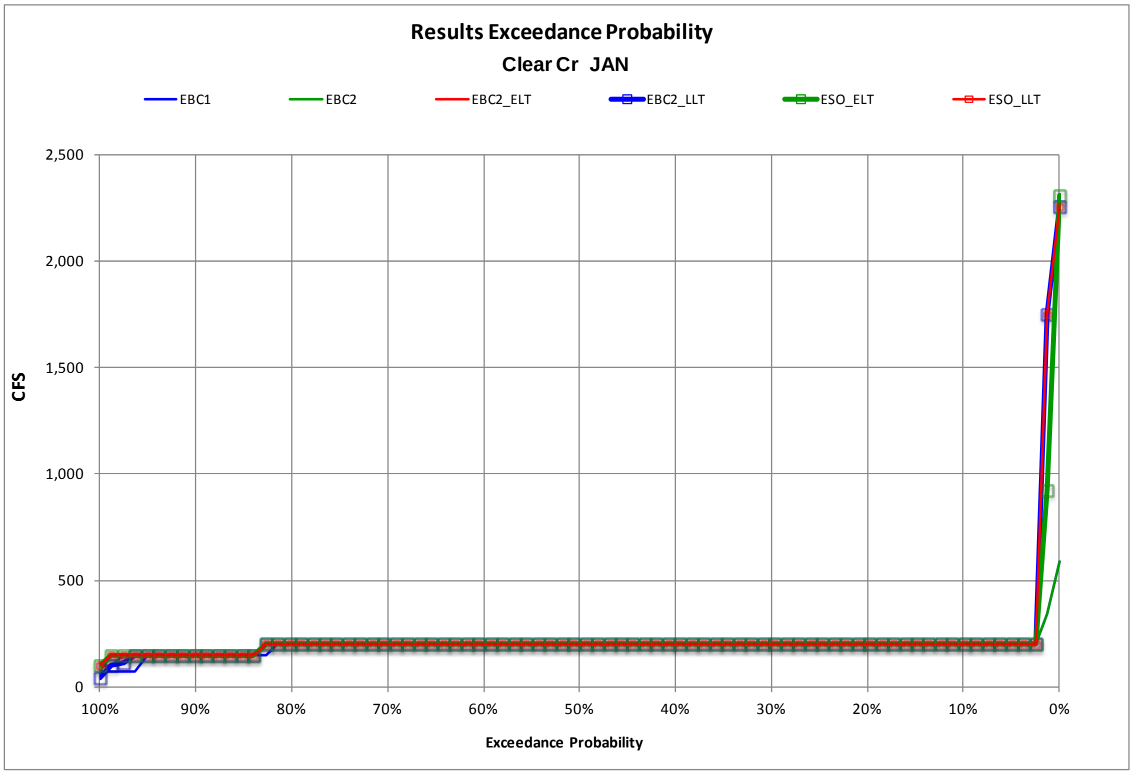


Figure 5C.5.2-84. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow Rate of Clear Creek below Whiskeytown, January

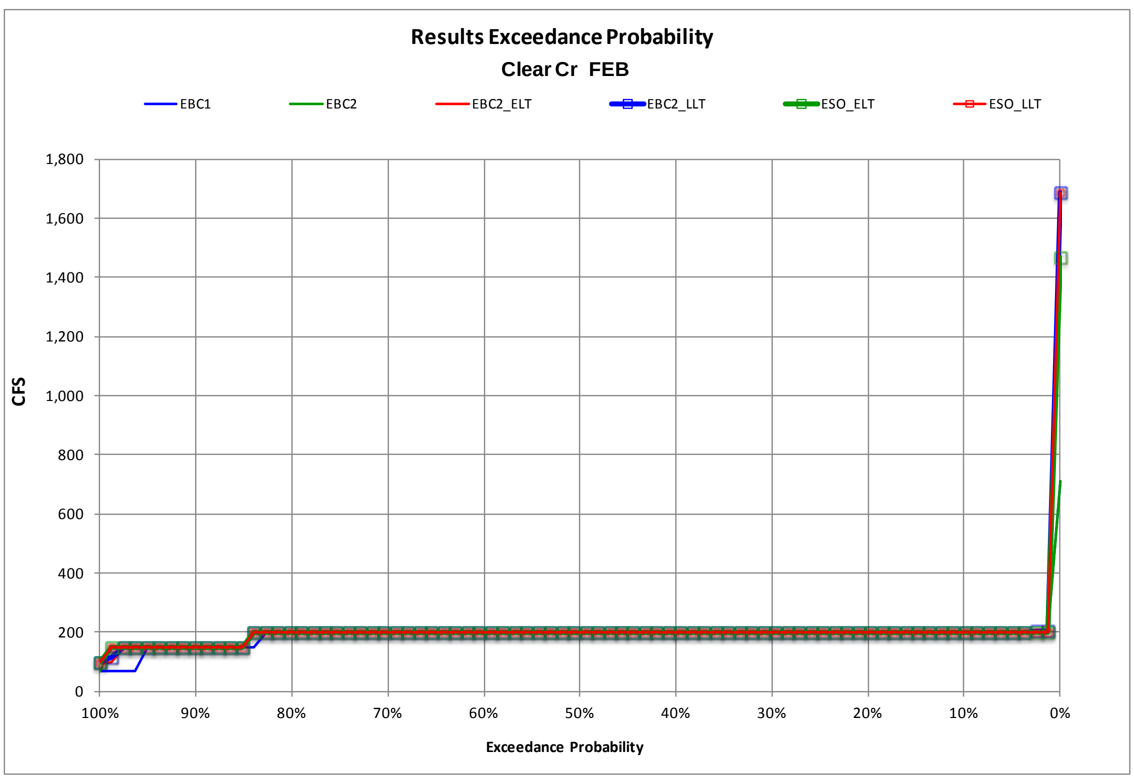


Figure 5C.5.2-85. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow Rate of Clear Creek below Whiskeytown, February

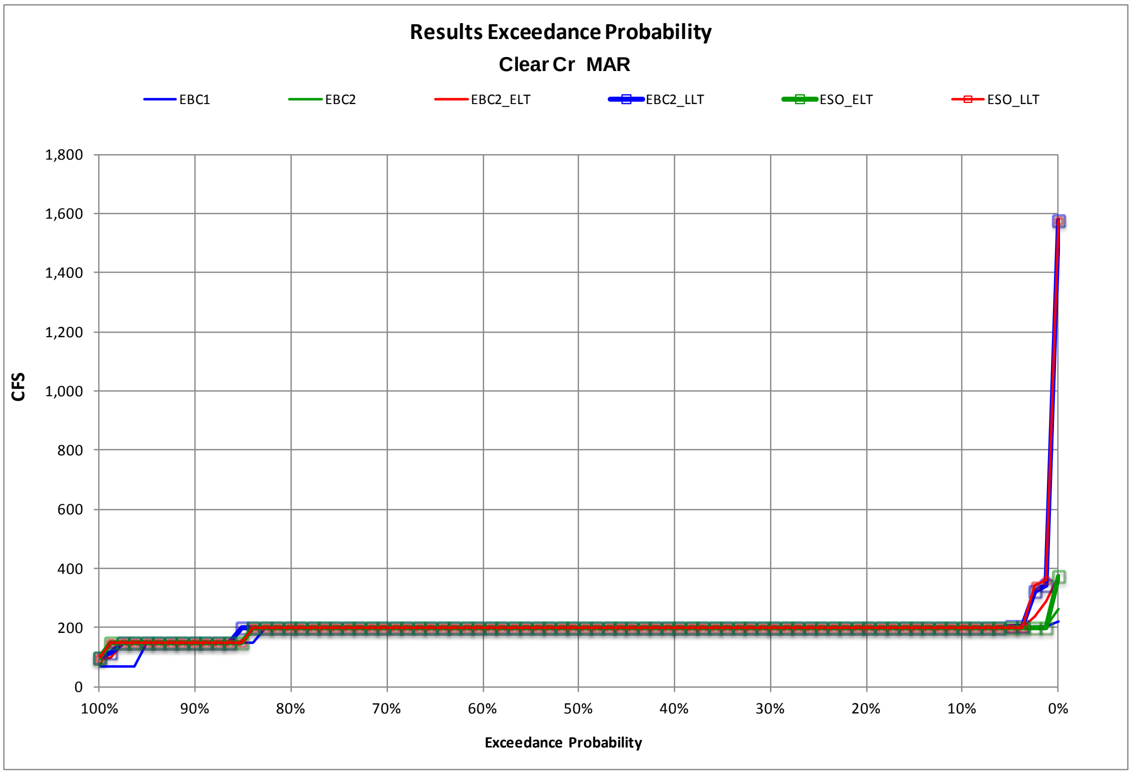


Figure 5C.5.2-86. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow Rate of Clear Creek below Whiskeytown, March

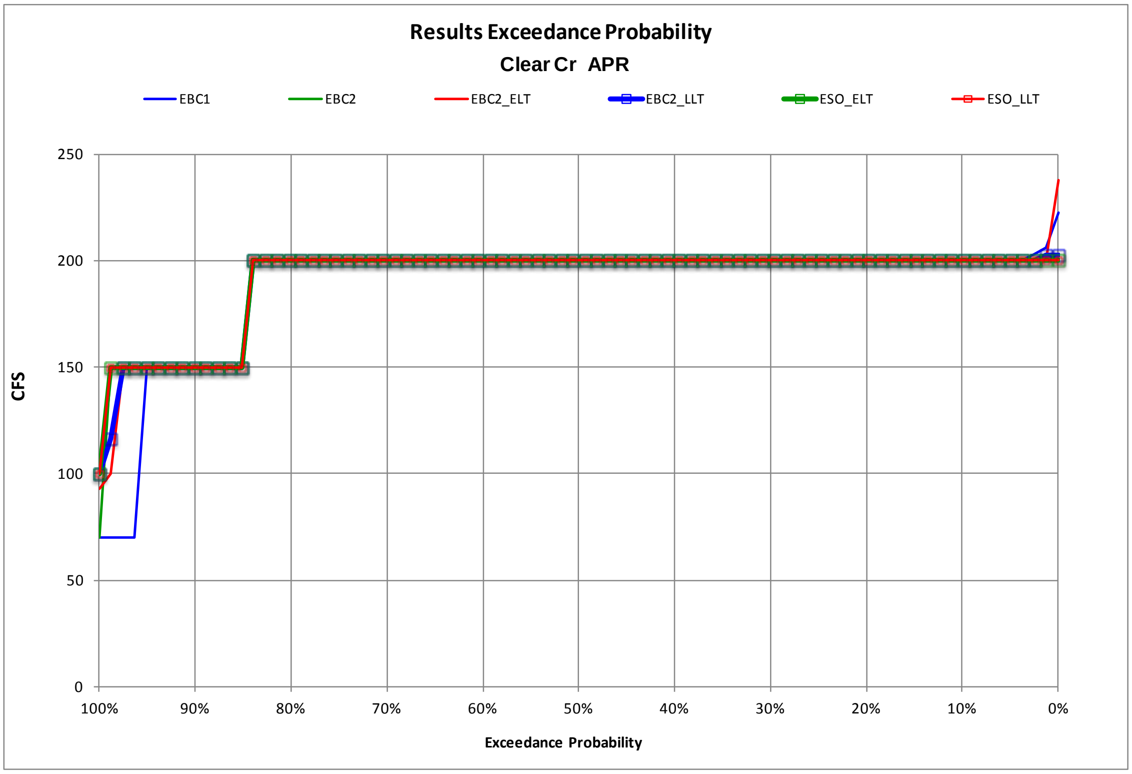


Figure 5C.5.2-87. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow Rate of Clear Creek below Whiskeytown, April

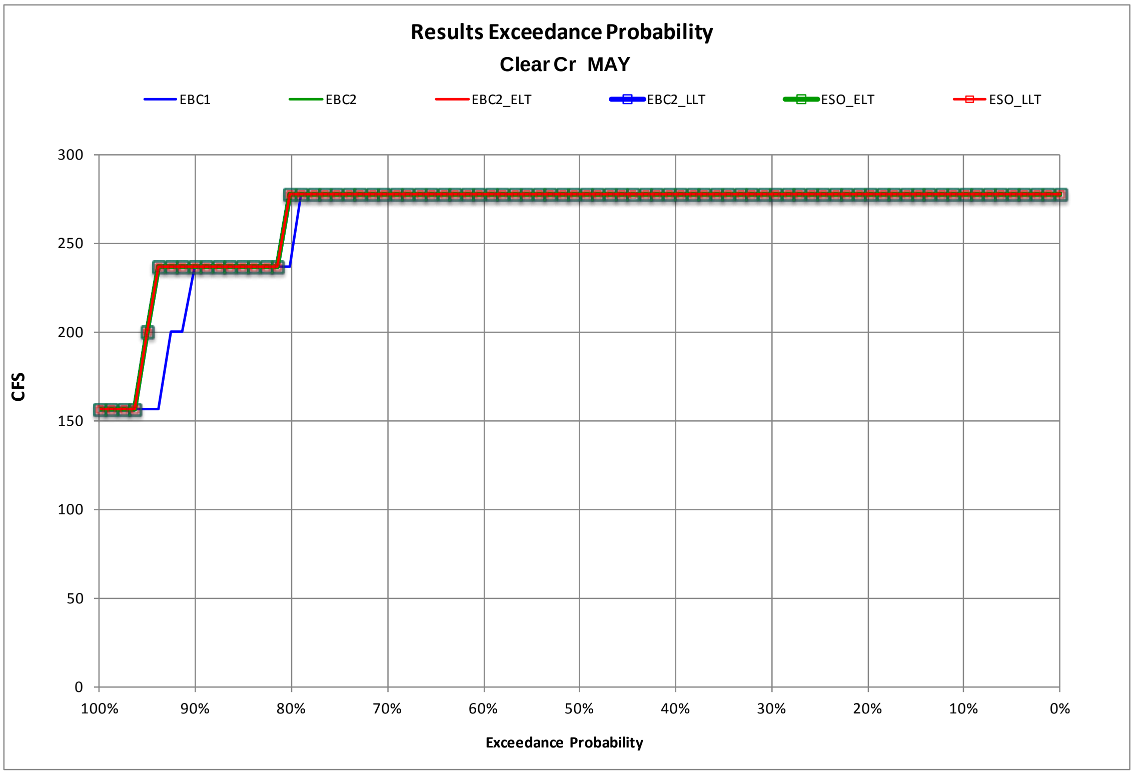


Figure 5C.5.2-88. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow Rate of Clear Creek below Whiskeytown, May

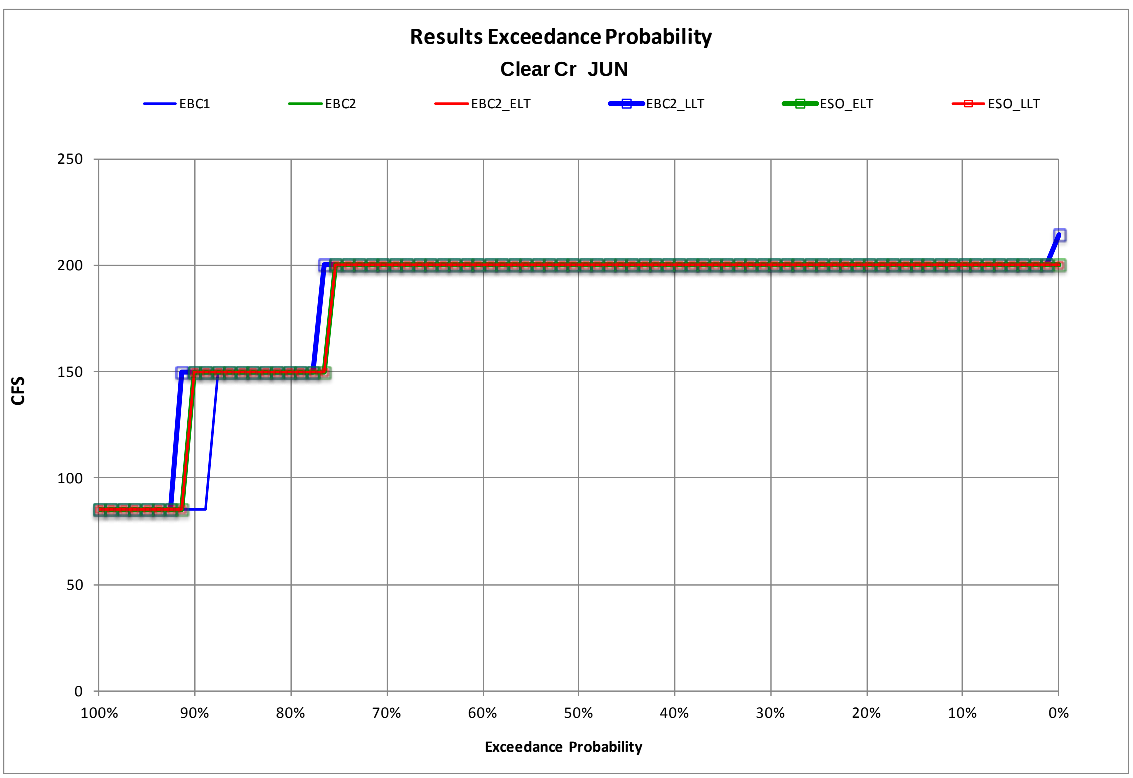


Figure 5C.5.2-89. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow Rate of Clear Creek below Whiskeytown, June

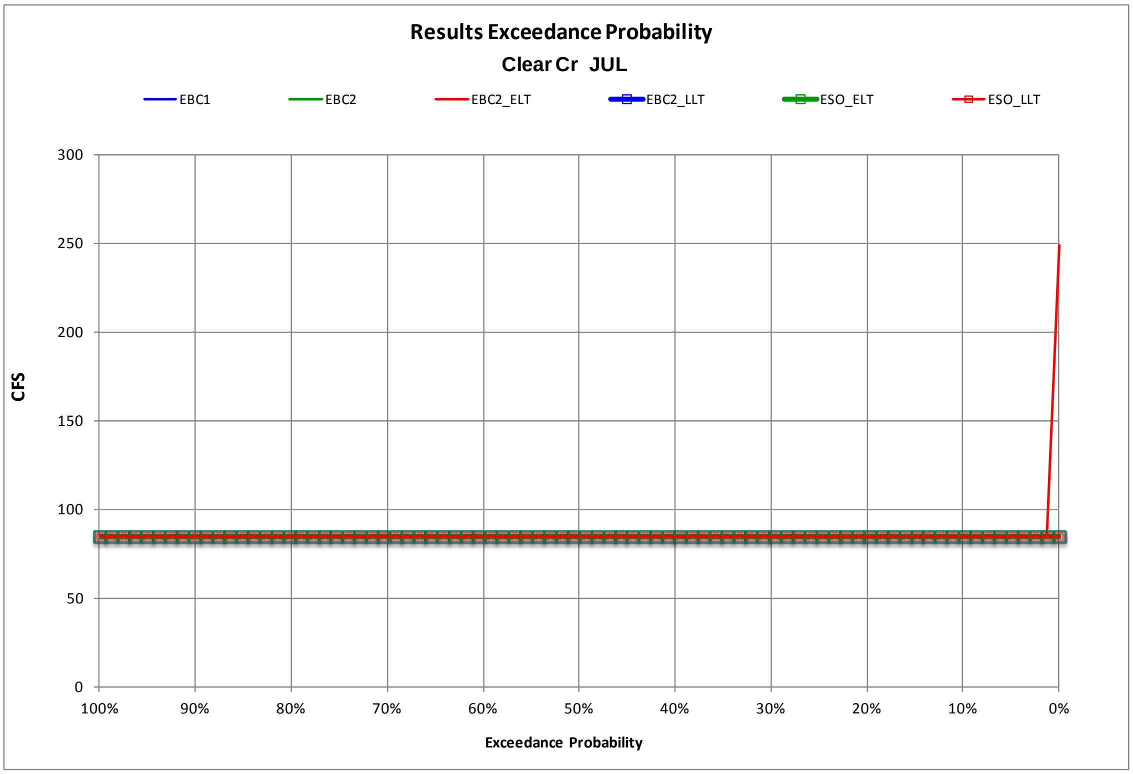


Figure 5C.5.2-90. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow Rate of Clear Creek below Whiskeytown, July

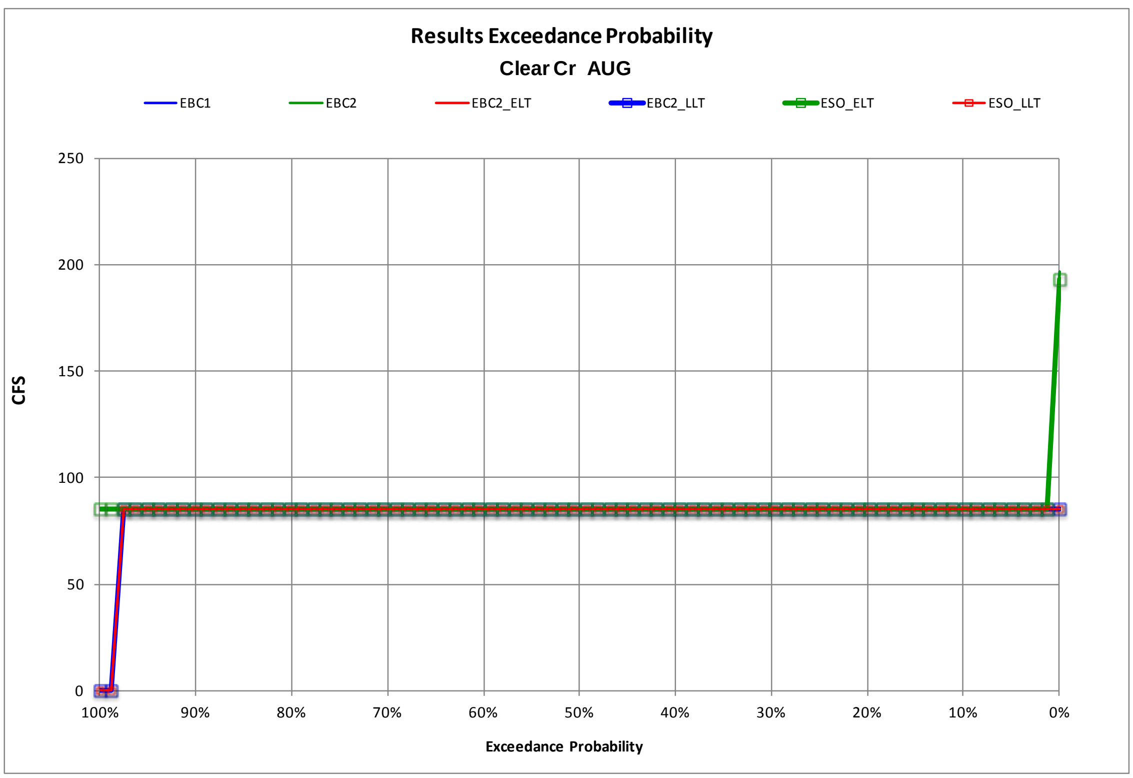


Figure 5C.5.2-91. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow Rate of Clear Creek below Whiskeytown, August

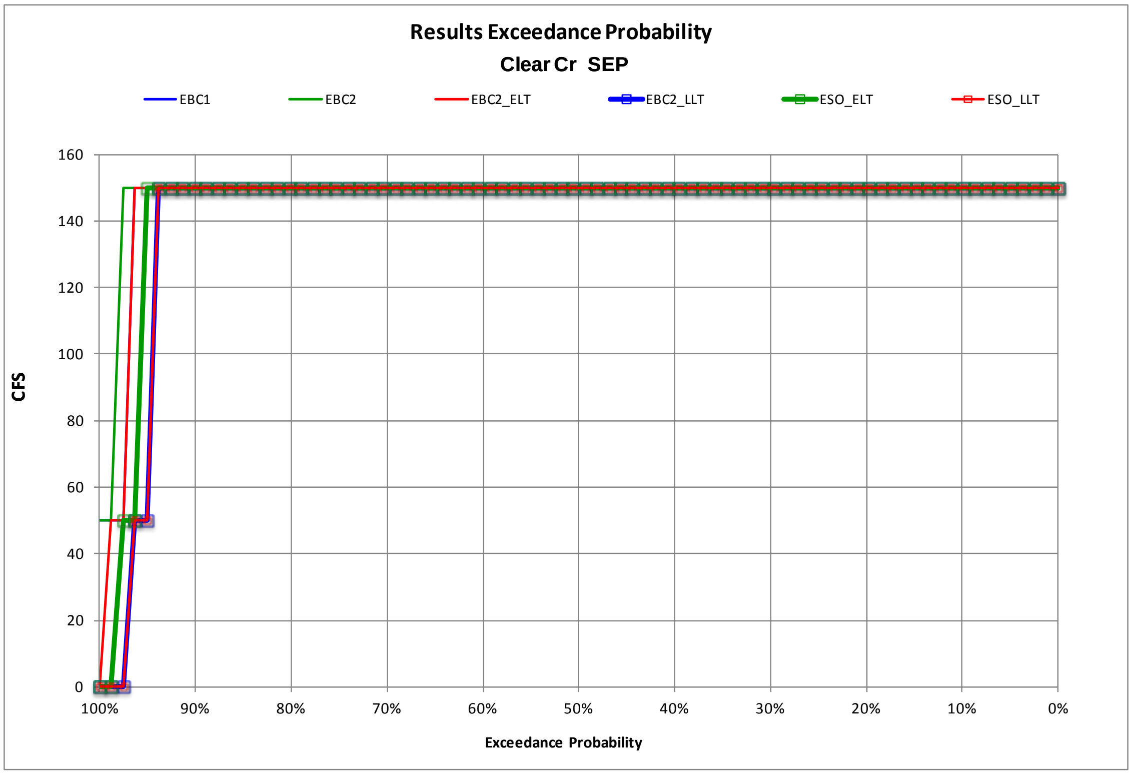


Figure 5C.5.2-92. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow Rate of Clear Creek below Whiskeytown, September

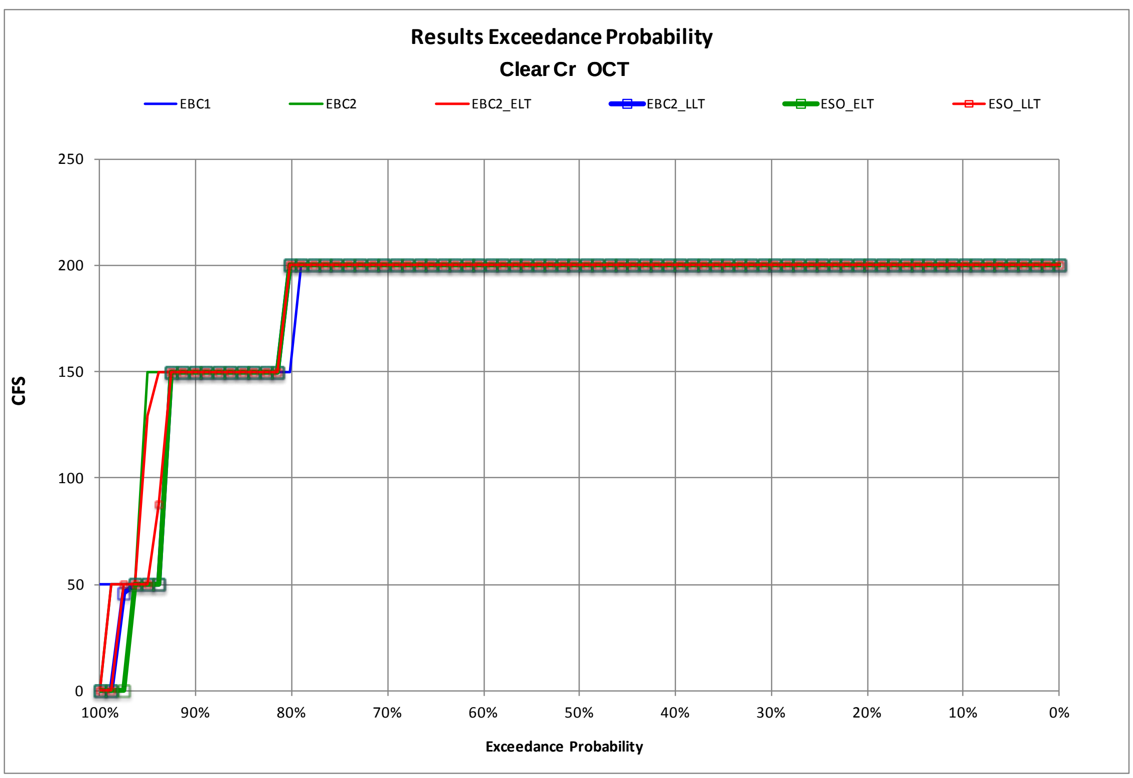


Figure 5C.5.2-93. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow Rate of Clear Creek below Whiskeytown, October

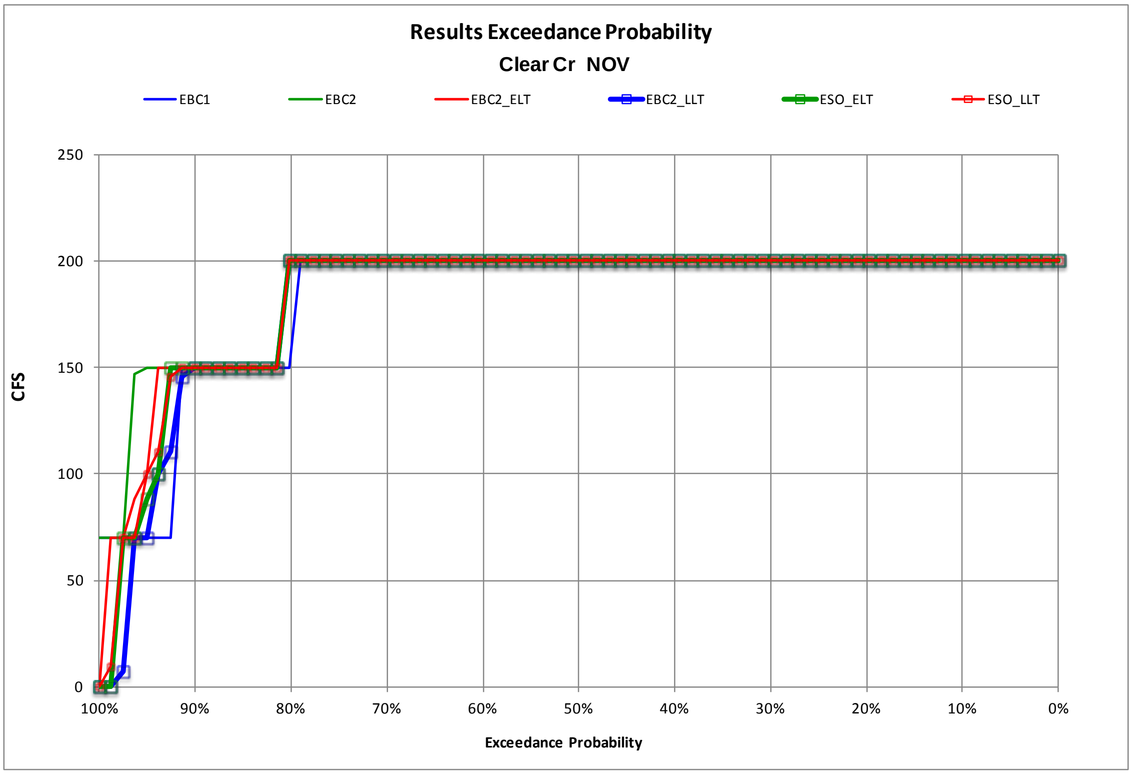


Figure 5C.5.2-94. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow Rate of Clear Creek below Whiskeytown, November

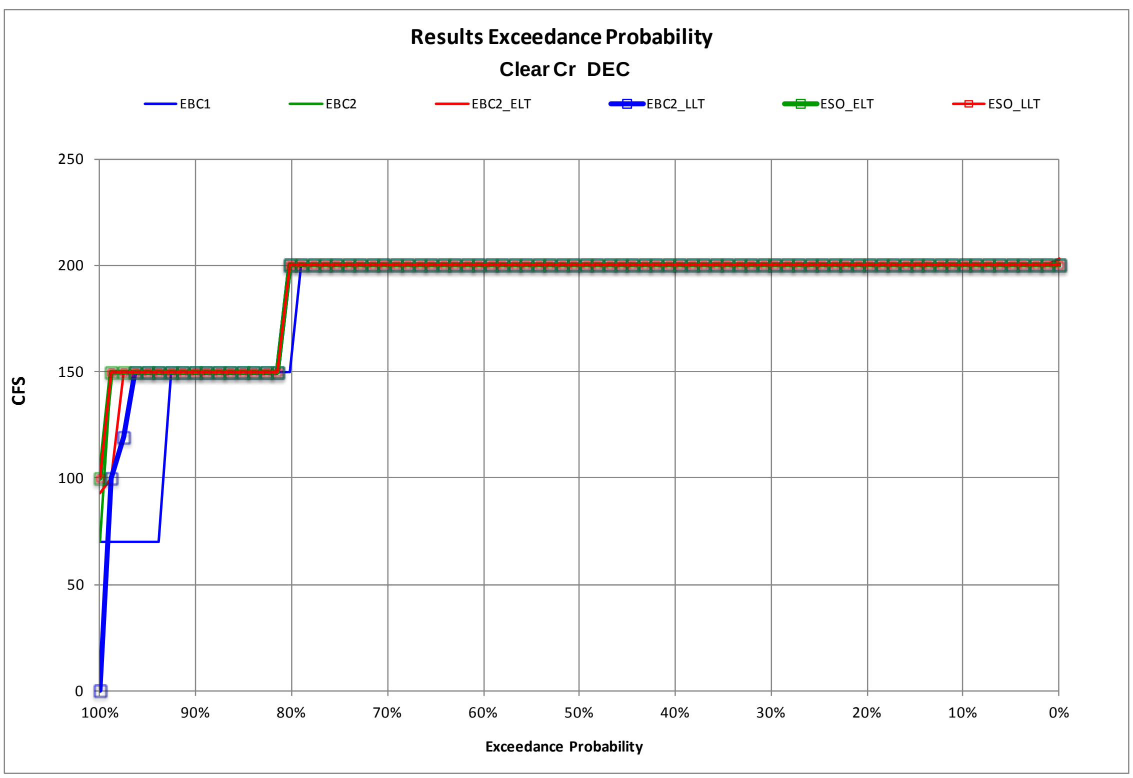


Figure 5C.5.2-95. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow Rate of Clear Creek below Whiskeytown, December

Table 5C.5.2-111. Mean Monthly Flows (cfs) in Clear Creek below Whiskeytown under ESO, HOS, and LOS Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	309	339	309	339	309	339
	AN	192	192	192	192	192	192
	BN	189	189	189	189	189	189
	D	192	192	192	192	192	192
	C	171	171	171	171	171	162
	All	225	235	225	235	225	234
Feb	W	249	257	249	257	249	257
	AN	196	196	196	196	196	196
	BN	189	189	189	189	189	189
	D	192	192	192	192	192	192
	C	171	171	171	171	171	171
	All	207	210	207	210	207	210
Mar	W	207	258	207	259	207	258
	AN	196	196	203	196	196	196
	BN	189	201	215	201	189	196
	D	192	192	192	192	192	192
	C	171	171	171	171	171	171
	All	194	212	199	212	194	211
Apr	W	200	200	200	200	200	200
	AN	196	196	203	196	196	196
	BN	189	189	189	189	189	196
	D	192	192	192	192	192	192
	C	171	171	171	171	171	171
	All	191	191	193	192	191	193
May	W	277	277	277	277	277	277
	AN	277	277	277	277	277	277
	BN	269	269	269	269	269	269
	D	264	264	264	264	264	264
	C	224	224	224	224	224	224
	All	265	265	265	265	265	265
Jun	W	200	200	200	200	200	200
	AN	200	200	200	200	200	200
	BN	186	186	186	186	186	186
	D	180	180	180	180	180	180
	C	120	120	120	120	120	120
	All	181	181	181	181	181	181
Jul	W	85	85	85	85	85	85
	AN	85	85	85	85	85	85
	BN	85	85	85	85	85	85
	D	85	85	85	85	85	85
	C	85	85	85	98	85	88
	All	85	85	85	87	85	85

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Aug	W	85	85	85	85	85	85
	AN	85	85	85	85	85	85
	BN	85	85	85	85	85	85
	D	85	85	85	85	85	85
	C	94	71	94	78	85	78
	All	86	83	86	84	85	84
Sep	W	150	150	150	150	150	150
	AN	150	150	150	150	150	150
	BN	150	150	150	150	150	150
	D	150	150	150	150	150	150
	C	108	96	121	96	121	96
	All	144	142	146	142	146	142
Oct	W	198	198	198	198	198	198
	AN	183	183	183	183	183	183
	BN	179	189	179	179	179	189
	D	175	180	183	175	175	175
	C	154	142	167	142	154	152
	All	181	182	185	179	181	183
Nov	W	198	198	198	198	198	198
	AN	180	182	185	182	180	182
	BN	189	189	189	189	189	189
	D	176	177	176	177	176	176
	C	158	158	158	158	158	145
	All	183	184	184	184	183	182
Dec	W	198	198	198	198	198	198
	AN	192	192	192	192	192	192
	BN	189	189	189	189	189	189
	D	189	189	189	189	189	189
	C	171	171	171	158	171	171
	All	190	190	190	188	190	190

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-112. Differences[a] between ESO Scenarios and HOS and LOS Scenarios in Flows (cfs) in Clear Creek below Whiskeytown

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	0 (0%)	0.2 (0.1%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0.1%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	-9 (-5.2%)
	All	0 (0%)	0 (0%)	0 (0%)	-1 (-0.6%)
Feb	W	0.2 (0.1%)	0.2 (0.1%)	0 (0%)	0 (0%)
	AN	0.1 (0.1%)	0.1 (0.1%)	0.2 (0.1%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	W	0.2 (0.1%)	0.2 (0.1%)	0 (0%)	0 (0%)
	AN	8 (3.9%)	0.1 (0.1%)	0.2 (0.1%)	0 (0%)
	BN	25 (13.4%)	0 (0%)	0 (0%)	-5 (-2.6%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	6 (2.8%)	0 (0%)	0 (0%)	-1 (-0.4%)
Apr	W	0.2 (0.1%)	0.2 (0.1%)	0 (0%)	0 (0%)
	AN	8 (3.9%)	0.1 (0.1%)	0.2 (0.1%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	6 (3.4%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	1 (0.6%)	0 (0%)	0 (0%)	1 (0.6%)
May	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0.1 (0.1%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	13 (15.5%)	0 (0%)	3 (3.3%)
	All	0 (0%)	2 (2.3%)	0 (0%)	0.4 (0.5%)

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	7 (10.3%)	-9 (-9.6%)	7 (10%)
	All	0 (0%)	1 (1.3%)	-1 (-1.5%)	1 (1.3%)
Sep	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	13 (11.5%)	0 (0%)	12 (11.5%)	0 (0%)
	All	2 (1.3%)	0 (0%)	2 (1.3%)	0 (0%)
Oct	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	-11 (-5.7%)	0 (0%)	0 (0%)
	D	8 (4.8%)	-5 (-2.7%)	0 (0%)	-5 (-2.7%)
	C	13 (8.1%)	0 (0%)	0 (0%)	11 (7.5%)
	All	4 (2%)	-3 (-1.6%)	0 (0%)	0.5 (0.3%)
Nov	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	5 (2.9%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	-0.1 (-0.1%)	0 (0%)	-1 (-0.3%)
	C	0 (0%)	0 (0%)	0 (0%)	-12 (-7.9%)
	All	1 (0.4%)	0 (0%)	0 (0%)	-2 (-1.1%)
Dec	W	0 (0%)	0.2 (0.1%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	-12 (-7.3%)	0 (0%)	0 (0%)
	All	0 (0%)	-2 (-0.9%)	0 (0%)	0 (0%)

[a] Positive values indicate greater flow under HOS or LOS than under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Water Temperature

Steelhead spawning and egg incubation occur primarily during the winter months when seasonal water temperatures are low and typically within the suitable range for these life stages. No simulation model exists for use in predicting water temperatures in Clear Creek. In the absence of model predictions, based on similarities in simulated flows, it was concluded that water temperatures under ESO_ELT and ESO_LLT would not differ from EBC2_ELT and EBC2_LLT, respectively (Table 5C.5.2-109, Table 5C.5.2-110, Figure 5C.5.2-84 through Figure 5C.5.2-87). Further, there would be no difference between the ESO scenarios and HOS and LOS scenarios (Table 5C.5.2-111, Table 5C.5.2-112).

Redd Dewatering

To evaluate the potential risk of redd dewatering for steelhead within Clear Creek, it was assumed that steelhead spawn in January and that the eggs and alevins incubate through April. In the absence of quantitative information on the relationship between instream flows and spawning habitat for steelhead within Clear Creek, an index of risk for redd dewatering was used. The index was based on the greatest percentage reduction in flows in any month during the egg incubation period when compared to the flows during the previous month when spawning was assumed to occur. Results of the flow analyses for the risk of redd dewatering are summarized in Table 5C.5.2-113. Differences between pairs of modeling scenarios are presented in Table 5C.5.2-114. These results indicate that the greatest reductions are identical between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT regardless of water-year type. Further, climate change would not affect the greatest monthly reduction in flows. Therefore, it was concluded that the ESO would not affect steelhead redd dewatering in Clear Creek. Because flows under HOS and LOS scenarios would generally be similar to flows under ESO (Table 5C.5.2-111, Table 5C.5.2-112), no analysis of redd dewatering risk was conducted for these scenarios.

Table 5C.5.2-113. Greatest Monthly Reduction (Percent Change) in Flow in Clear Creek below Whiskeytown during the January through April Steelhead Spawning and Egg Incubation Period under EBC and ESO Scenarios[a]

Water-Year Type	Scenario[b,c]					
	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Wet	-66[c]	-66	-91	-91	-91	-91
Above Normal	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0
Dry	0	0	0	0	0	0
Critical	0	0	0	0	0	0

[a] Redd dewatering risk not applicable for months when flows during the egg incubation period were at or greater than flows in the month when spawning is assumed to occur.
[b] See Table 5C.0-1 for definitions of the scenarios.
[c] A negative value indicates a reduction in flows.

Table 5C.5.2-114. Differences in Greatest Monthly Reduction (Percentage Change) between EBC and ESO Scenarios in Flow in Clear Creek below Whiskeytown during the January through April Steelhead Spawning and Egg Incubation Period[a]

Water-Year Type	Scenario[b,c]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Wet	-25 (-38%)[c]	-25 (-38%)	-25 (-38%)	-25 (-38%)	0 (0%)	0 (0%)
Above Normal	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)

[a] Redd dewatering risk not applicable for months when flows during the egg incubation period were at or greater than flows in the month when spawning is assumed to occur.
[b] See Table 5C.0-1 for definitions of the scenarios.
[c] A negative value indicates that the greatest monthly reduction would be of greater magnitude (worse) under the ESO than under the EBC.
NA = Could not calculate, dividing by 0.

5C.5.2.3.1.2 Fry and Juvenile Rearing

Rearing Habitat

Steelhead fry and juveniles rear in Clear Creek throughout the year. Mean monthly instream flows in Clear Creek below Whiskeytown from CALSIM are presented in Table 5C.5.2-109 and differences between pairs of model scenarios are presented in Table 5C.5.2-110. Exceedance plots are presented by month in Figure 5C.5.2-84 through Figure 5C.5.2-95. These results indicate that flows in Clear Creek would largely be similar between the EBC2 and ESO scenarios, with few exceptions ranging from a 14% reduction in critical water years during July in the ELT to an 11% increase in critical water years during August. These infrequent differences between model scenarios are not expected to cause a biologically meaningful effect on year-round fry and juvenile rearing habitat conditions in Clear Creek. Further, flows under HOS and LOS scenarios would generally be similar to flows under ESO (Table 5C.5.2-111, Table 5C.5.2-112).

An additional analysis to determine the potential effects of the ESO on juvenile steelhead rearing conditions in Clear Creek was conducted that is based on the assumption that habitat for juvenile steelhead rearing would be constrained by the month having the lowest instream flows. Because flows under HOS and LOS scenarios would generally be similar to flows under ESO (Table 5C.5.2-111, Table 5C.5.2-112), this analysis was not conducted for these scenarios. Juvenile rearing habitat increases in Clear Creek as instream flows increase above the minimum levels and, therefore, the use of the lowest monthly instream flow as an index of habitat constraints for juvenile rearing was selected for use in this analysis. Results of the analysis of minimum mean monthly instream flows affecting juvenile rearing habitat are shown in Table 5C.5.2-115 and Table 5C.5.2-116. Results indicate that minimum flows under EBC2_ELT and EBC2_LLT would generally be similar to flows under the ESO_ELT and ESO_LLT, respectively, in wet, above normal, and critical water years. In below normal water years, minium flows would be identical betwewn EBC2_ELT and ESO_ELT and 86% greater under ESO_LLT realtive to EBC2_LLT. In dry years, mean minimum flows would be 100% lower (reduction from 50 cfs to 0 cfs) under ESO_ELT than under EBC2_ELT and 575% greater (increase from 7 cfs to 50 cfs) under ESO_LLT relative to EBC2_LLT.Due to the overall lack of differences between EBC2 and ESO scenarios, it was concluded that there would be no biologically meaningful effect of the ESO on juvenile steelhead rearing habitat conditions (as constrained by the lowest monthly instream flow) in Clear Creek.

Table 5C.5.2-115. Mean Minimum Monthly Flow (cfs) in Clear Creek below Whiskeytown under EBC and ESO Scenarios

Water-Year Type	Scenario[a]					
	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Wet	85	85	85	85	85	85
Above Normal	50	50	50	50	50	50
Below Normal	70	0	0	46	0	85
Dry	50	50	50	7	0	50
Critical	50	50	0	0	0	0

[a] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-116. Differences[a] between EBC and ESO Scenarios in Mean Minimum Monthly Flow (cfs) in Clear Creek below Whiskeytown

Water-Year Type	Scenarios[b]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Wet	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Above Normal	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Below Normal	-70 (-100%)	15 (21%)	0 (0%)	85 (0%)	0 (NA)	39 (86%)
Dry	-50 (-100%)	0 (0%)	-50 (-100%)	0 (0%)	-50 (-100%)	43 (575%)
Critical	-50 (-100%)	-50 (-100%)	-50 (-100%)	-50 (-100%)	0 (NA)	0 (NA)

[a] Negative values indicate lower minimum flow under ESO than under EBC.
[b] See Table 5C.0-1 for definitions of the scenarios.
NA = Could not calculate, dividing by 0.

Denton (1986) developed flow recommendations for steelhead in Clear Creek using IFIM (Figure 5C.5.2-96). The current Clear Creek management regime uses flows slightly lower than those recommended by Denton. Results from a new IFIM study on Clear Creek are currently being analyzed. Depending on results of this study, the flow regime could be adjusted in the future. We conclude that, based on general similarities in flows between EBC2 scenarios and ESO, HOS, and LOS scenariosno effect of ESO, HOS, and LOS scenarios on steelhead fry and juvenile rearing in Clear Creek is anticipated.

Combined, these results indicate that the ESO, HOS, and LOS would not cause any flow-related effects to fry and juvenile steelhead rearing habitat conditions in Clear Creek. Because these results are based on CALSIM-generated data, there is moderate certainty in this conclusion.

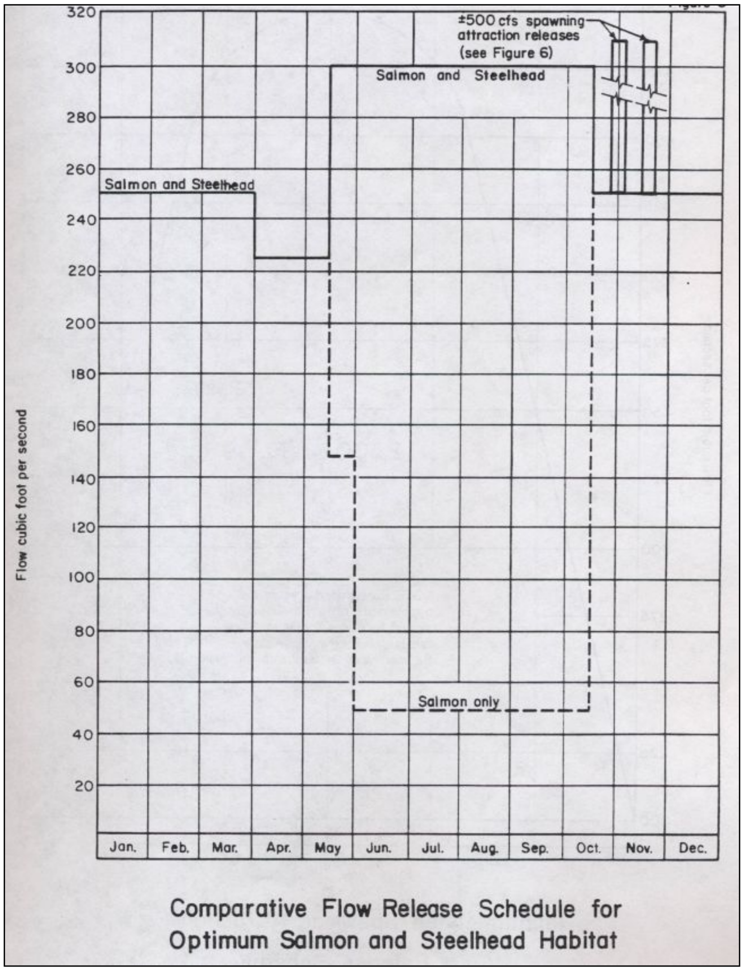


Figure 5C.5.2-96. Clear Creek Flow Recommendations from Denton (1986) Instream Flow Incremental Methodology Study

5C.5.2.3.1.3 Adult

Water Temperature

Adult steelhead migrate upstream during September through March and kelts migrate back downstream during March and April. Water temperatures in Clear Creek are not modeled in the Reclamation Temperature Model. Therefore, the analysis to determine whether the ESO would cause any water temperature-related effects relied on instream flows as a surrogate. As reported above, there would be no biologically meaningful effects of ESO, HOS, or LOS on instream flows (Table 5C.5.2-109, Table 5C.5.2-110, Figure 5C.5.2-84 through Figure 5C.5.2-86 and Figure 5C.5.2-92 through Figure 5C.5.2-95, Table 5C.5.2-111, Table 5C.5.2-112).

5C.5.2.3.2 Spring-Run

5C.5.2.3.2.1 Eggs and Alevins

Upstream Spawning Habitat

Spring-run Chinook salmon use Clear Creek downstream of the water delivery point from Whiskeytown Reservoir for spawning and egg incubation. Clear Creek currently supports a population of adult spring-run Chinook salmon of approximately 200 individuals.

Instream flows in Clear Creek below Whiskeytown during the spring-run Chinook salmon spawning and egg incubation period (September through January) are presented in Table 5C.5.2-109, Figure 5C.5.2-84, and Figure 5C.5.2-92 through Figure 5C.5.2-95. Differences between pairs of model scenarios by month and water-year type are presented in Table 5C.5.2-110. Flows during these months would generally be similar between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT, except in critical years during September and October in the ELT (10% and 7% lower, respectively) and in critical years during November through January in the LLT (7% to 10% higher). These changes to Clear Creek flows due to the ESO would not be biologically meaningful because they are small and infrequent. Further, flows under HOS and LOS would generally be similar to flows under ESO (Table 5C.5.2-111, Table 5C.5.2-112). Therefore, it is concluded that there are no flow-related effects of ESO, HOS, and LOS scenarios on spring-run spawning and egg incubation habitat in Clear Creek.

Water Temperature

Currently, no water temperature model exists for predicting water temperatures in Clear Creek. In the absence of model predictions, it was assumed that water temperatures would be negatively correlated with instream flows. As described above, there would be no biologically meaningful effects of ESO, HOS, or LOS scenarios on flows in Clear Creek during the spring-run spawning and egg incubation period. Therefore, there would be no temperature-related effects during the spring-run spawning and egg incubation period.

Redd Dewatering

To evaluate the potential risk of redd dewatering for steelhead within Clear Creek, it was assumed that spring-run Chinook salmon spawn in September and that the eggs and alevins incubate through January. Redd dewatering risks would not occur for months when flows during the egg incubation period were at or greater than flows in the month when spawning occurred. Results of monthly CALSIM flows were used to determine the magnitude of flow reduction that would occur each month during the incubation period compared to the flow in September when spawning was assumed to occur. The index of risk for redd dewatering is based on the greatest percentage change (reduction) in flows in any month during the egg incubation period when compared to the flows during the month spawning was assumed to occur. Results of the flow analyses for the risk of redd dewatering are summarized in Table 5C.5.2-117. Differences between pairs of modeling scenarios are presented in Table 5C.5.2-118. Results indicate that there would be no differences in the greatest monthly flow reductions between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT regardless of water-year type. Further, climate change would not affect the greatest monthly reduction in flows. Therefore, it was concluded that the ESO would not affect spring-run redd dewatering in the Clear Creek. Because flows under HOS and LOS scenarios would generally be similar to flows under ESO

(Table 5C.5.2-111, Table 5C.5.2-112), no analysis of redd dewatering risk was conducted for these scenarios.

Table 5C.5.2-117. Greatest Monthly Reduction (Percentage Change) in Flow in Clear Creek below Whiskeytown during the September through January Spring-Run Chinook Salmon Spawning and Egg Incubation Period under EBC and ESO Scenarios[a]

Water-Year Type	Scenario[b,c]					
	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Wet	0	0	0	0	0	0
Above Normal	0	-2	-41	-27	-41	-27
Below Normal	-53	0	0	0	0	0
Dry	0	-67	-67	-67	-67	-67
Critical	-67	-100	-100	-100	-100	-100

[a] Redd dewatering risk not applicable for months when flows during the egg incubation period were at or greater than flows in the month when spawning is assumed to occur.
[b] See Table 5C.0-1 for definitions of the scenarios.
[c] A negative value indicates a reduction in flows.

Table 5C.5.2-118. Differences between EBC and ESO Scenariosin Greatest Monthly Reduction (Percentage Change) in Flow (cfs) in Clear Creek below Whiskeytown during the September through January Spring-Run Chinook Salmon Spawning and Egg Incubation Period[a]

Water-Year Type	Scenarios[b,c]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Wet	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
Above Normal	-41 (NA)	-27 (NA)	-39 (-1967%)	-25 (-1233%)	0 (0%)	0 (0%)
Below Normal	53 (100%)	53 (100%)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
Dry	-67 (NA)	-67 (NA)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	-33 (-50%)	-33 (-50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

[a] Redd dewatering risk not applicable for months when flows during the egg incubation period were at or greater than flows in the month when spawning is assumed to occur.
[b] See Table 5C.0-1 for definitions of the scenarios.
[c] A negative value indicates that the greatest monthly reduction would be of greater magnitude (worse) under the ESO than under the EBC.
NA = Could not calculate, dividing by 0.

5C.5.2.3.2.2 Fry and Juvenile Rearing

Rearing Habitat

Examination of predicted Clear Creek below Whiskeytown instream flows by month and water-year type during the November through March spring-run Chinook salmon rearing period showed that instream flows and physical habitat conditions (e.g., water depths, velocities, wetted cross section) are predicted to be similar between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT (Table 5C.5.2-109). The only months with differences between scenarios are during critical water years and would be both higher and lower under the ESO depending on month. Based on these results, it was concluded that the ESO would have no flow-related effects on spring-run juvenile rearing habitat conditions in Clear Creek. Further, flows under HOS and LOS scenarios would generally be similar to flows under ESO (Table 5C.5.2-111, Table 5C.5.2-112). It was assumed that juvenile spring-run salmon rearing habitat would be constrained by the month having the lowest instream flows. Juvenile rearing habitat is assumed to increase in Clear Creek as instream flows increase. Therefore, the use of the lowest monthly instream flow as an index of habitat constraints for fry and juvenile rearing was selected for use in this analysis. Results of the analysis of minimum monthly instream flows affecting fry and juvenile rearing habitat are shown in Table 5C.5.2-115 and differences between pairs of model scenarios are shown in Table 5C.5.2-116. Results predict that minimum flows would be identical between EBC2_ELT and ESO_ELT or between EBC2_LLT and ESO_LLT, regardless of water-year type. Therefore, there would be no effect of the ESO on juvenile spring-run Chinook salmon rearing habitat (as constrained by the lowest monthly instream flows) within Clear Creek. Because flows under HOS and LOS scenarios would generally be similar to flows under ESO (Table 5C.5.2-111, Table 5C.5.2-112), this analysis was not conducted for these scenarios.

5C.5.2.3.2.3 Adult

Water Temperature

Adult spring-run Chinook salmon migrate and hold upstream during April through August prior to spawning beginning in September. Due to a lack of quantitative modeling, the evaluation of effects to water temperature employed modeled Clear Creek flows as a surrogate. Monthly mean flows by water-year type in Clear Creek below Whiskeytown are presented in Table 5C.5.2-109 and differences between pairs of model scenarios are presented in Table 5C.5.2-110. Monthly frequency of exceedance plots for Clear Creek flows are presented in Figure 5C.5.2-87 through Figure 5C.5.2-91. For nearly all months and all water-year types during the migration and holding period, there are no differences in flows between EBC2_ELT and ESO_ELT or between EBC2_LLT and ESO_LLT. There are three exceptions, all occurring in critical water years: a 14% reduction during July in the ELT implementation period, an 11% increase during August in the ELT, and an 8% reduction during June in the LLT. Further, flows under HOS and LOS scenarios would generally be similar to flows under ESO (Table 5C.5.2-111, Table 5C.5.2-112). Overall, these results indicate that ESO, HOS, and LOS scenarios would not affect flows and, therefore, water temperatures in Clear Creek during the spring-run adult migration and holding period.

5C.5.2.3.3 Fall-Run/Late Fall–Run

5C.5.2.3.3.1 Eggs and Alevins

Upstream Spawning Habitat

Fall-run Chinook salmon adults hold and spawn and eggs rear in Clear Creek downstream of the water delivery point from Whiskeytown Reservoir during September through February. Monthly mean flows by water-year type in Clear Creek below Whiskeytown are presented in Table 5C.5.2-109 and differences between pairs of model scenarios are presented in Table 5C.5.2-110. Monthly frequency of exceedance plots for Clear Creek flows are presented in Figure 5C.5.2-84 and Figure 5C.5.2-93 through Figure 5C.5.2-95. Flows during the September through February period are nearly always similar between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT, except in critical years during September and October under the ELT implementation period (10% and 7% lower under ESO_ELT, respectively) and in critical years during November through January in the LLT implementation period (7% to 10% higher under ESO_LLT). These results indicate that there would be no meaningful differences in instream flow between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT during the October through January period. Flows under HOS and LOS scenarios would generally be similar to flows under ESO during this period with few low magnitude exceptions (Table 5C.5.2-111, Table 5C.5.2-112). Therefore, there would be no flow-related effects of ESO, HOS, and LOS scenarios on fall-run Chinook salmon spawning and egg incubation in Clear Creek.

Water Temperature

Fall-run Chinook salmon spawning and egg incubation occurs in Clear Creek during the early fall (i.e., September through February) when seasonal air temperatures in the Redding area decline seasonally. No simulation model exists for use in predicting water temperatures in Clear Creek. As a result, modeled Clear Creek flows were used as a surrogate to water temperature under the assumptions that flows and water temperatures were negatively correlated. Based on flow results described above, it was concluded that there would be no water temperature related effects of the ESO on fall-run Chinook salmon spawning and egg incubation habitat in Clear Creek (Table 5C.5.2-109, Table 5C.5.2-110, Figure 5C.5.2-84 and Figure 5C.5.2-93 through Figure 5C.5.2-95, Table 5C.5.2-111, Table 5C.5.2-112).

Redd Dewatering

To evaluate the potential risk of redd dewatering for fall-run Chinook salmon within Clear Creek, it was assumed that fall-run Chinook salmon spawn primarily in September and that the eggs and alevins incubate through February. Redd dewatering risks would not occur for months when flows during the egg incubation period were at or greater than flows in the month when spawning occurred. Results of monthly CALSIM flows were used to determine the magnitude of flow reduction that would occur each month during the incubation period compared to the flow in September when spawning was assumed to occur. The index of risk for redd dewatering is based on the greatest percentage change (reduction) in flows in any month during the egg incubation period when compared to the flows during the month spawning was assumed to occur. Results of the flow analyses for the risk of redd dewatering are summarized in Table 5C.5.2-119. Differences between pairs of modeling scenarios are presented in Table 5C.5.2-120. Results indicate that there would generally be no differences in the greatest monthly flow reductions between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. Climate change would affect the greatest monthly reduction in flows. Based on these results, it was concluded that the ESO would not affect fall-run redd dewatering in Clear Creek. Due to similarities in Clear Creek flows between the ESO scenario and HOS and LOS scenarios (Table 5C.5.2-111, Table 5C.5.2-112), this analysis was not conducted for HOS and LOS scenarios.

Table 5C.5.2-119. Greatest Monthly Reduction (Percentage Change) in Instream Flow in Clear Creek below Whiskeytown during the September through February Fall-Run Chinook Salmon Spawning and Egg Incubation Period under EBC and ESO Scenarios[a]

Water-Year Type	Scenario[b,c]					
	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Wet	0	0	0	0	0	0
Above Normal	0	-2	-41	-27	-41	-27
Below Normal	-53	0	0	0	0	0
Dry	0	-67	-67	-67	-67	-67
Critical	-67	-100	-100	-100	-100	-100

[a] Redd dewatering risk not applicable for months when flows during the egg incubation period were at or greater than flows in the month when spawning is assumed to occur.
[b] See Table 5C.0-1 for definitions of the scenarios.
[c] A negative value indicates a reduction in flows.

Table 5C.5.2-120. Differences between EBC and ESO Scenarios in Greatest Monthly Reduction (Percentage Change) in Flow (cfs) in Clear Creek below Whiskeytown during the September through February Fall-Run Chinook Salmon Spawning and Egg Incubation Period[a]

Water-Year Type	Scenarios[b,c]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Wet	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
Above Normal	-41 (NA)c	-27 (NA)	-39 (-1967%)	-25 (-1233%)	0 (0%)	0 (0%)
Below Normal	53 (100%)	53 (100%)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
Dry	-67 (NA)	-67 (NA)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	-33 (-50%)	-33 (-50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Redd dewatering risk not applicable for months when flows during the egg incubation period were at or greater than flows in the month when spawning is assumed to occur.
[b] See Table 5C.0-1 for definitions of the scenarios.
[c] A negative value indicates that the greatest monthly reduction would be of greater magnitude (worse) under the ESO than under the EBC.
NA = Could not calculate, dividing by 0.

5C.5.2.3.3.2 Fry and Juvenile Rearing

Rearing Habitat

CALSIM modeling of instream flows in Clear Creek (Table 5C.5.2-109, Table 5C.5.2-110., Figure 5C.5.2-84 through Figure 5C.5.2-88 during the juvenile fall-run Chinook salmon rearing period (January through May) predict that instream flows under ESO_ELT and ESO_LLT would be similar to or higher than those under EBC2_ELT and EBC2_LLT. Further, flows under HOS and LOS scenarios would generally be similar to flows under ESO during this period (Table 5C.5.2-111, Table 5C.5.2-112). Based on these results, it was concluded that ESO, HOS, and LOS scenarios would not affect instream habitat conditions (e.g., water depths, velocities, wetted cross-sections) for juvenile fall-run Chinook salmon rearing within Clear Creek.

5C.5.2.3.3.3 Adult

Water Temperature

Adult fall-run Chinook salmon generally migrate upstream in Clear Creek during August through December prior to spawning in October through January. Monthly mean flows by water-year type in Clear Creek below Whiskeytown are presented in Table 5C.5.2-109 and differences between pairs of model scenarios are presented in Table 5C.5.2-110. Monthly frequency of exceedance plots for Clear Creek flows are presented in Figure 5C.5.2-91 through Figure 5C.5.2-95. For nearly all months and all water-year types during the migration and holding period, there are no differences in flows between EBC2_ELT and ESO_ELT or between EBC2_LLT and ESO_LLT, except in critical years during October during the ELT (7% lower in ESO_ELT) and in critical years during November through January in the LLT (7% to 10% higher under ESO_LLT). Further, flows under HOS and LOS scenarios would generally be similar to flows under ESO during this period (Table 5C.5.2-111, Table 5C.5.2-112). These differences are small and infrequent and, therefore, it is concluded that ESO, HOS, and LOS scenarios would not affect flows or temperatures in Clear Creek during the fall-run adult migration and holding period.

5C.5.2.4 Feather River

5C.5.2.4.1 Steelhead

5C.5.2.4.1.1 Eggs and Alevins

Upstream Spawning Habitat

The two primary potential effects of BDCP operations on habitat conditions for steelhead spawning and egg incubation in the mainstem Feather River relate to changes in either instream flows or seasonal water temperatures released from Oroville Dam or Thermalito Afterbay. Instream flows affect physical habitat value and availability through changes in wetted channel width, water depth, and water velocities. The primary seasonal period for spawning and egg incubation extends from January through April. Steelhead spawning and egg incubation on the Feather River occurs primarily in Hatchery Ditch and the low-flow channel in the general vicinity of the Feather River Hatchery (Cavallo et al. 2003). Results of the CALSIM analyses of instream flows within the reach where the majority of steelhead spawning occurs (above Thermalito Afterbay, or the “low-flow channel”) were compared among model scenarios by month and water-year type. Flows at Thermalito Afterbay, or the “high-flow channel”, were also examined for each model scenario, as a small number of steelhead spawn in this reach (Cavallo et al. 2003). Average flows by month and water-year type for each model scenario are presented in Table 5C.5.2-121 for the low-flow channel and Table 5C.5.2-123 for the high-flow channel. Differences between pairs of model scenarios are presented in Table 5C.5.2-122 for the low-flow channel and in Table 5C.5.2-124 for the high-flow channel. Year-round monthly frequency of exceedance plots for flows are presented in Figure 5C.5.2-97 through Figure 5C.5.2-108 and Figure 5C.5.2-109 through Figure 5C.5.2-120 for the low-flow and high-flow channels, respectively. Monthly frequency of flow exceedance plots specific to the January through April steelhead spawning and egg incubation period are presented in Figure 5C.5.2-97 through Figure 5C.5.2-100 and Figure 5C.5.2-109 through Figure 5C.5.2-112 for the low-flow and high-flow channels, respectively.

Results suggest that instream flows in the Feather River low-flow channel would be the same for all modeled scenarios and water-year types (Table 5C.5.2-121; Table 5C.5.2-122; Figure 5C.5.2-97 through Figure 5C.5.2-100). Flows are predicted to range from 700 to 800 cfs under all conditions. Therefore, BDCP implementation is not expected to affect physical habitat conditions for steelhead spawning and egg incubation within the Feather River low-flow channel. Further, flows under HOS and LOS scenarios would not be different from those under ESO (Table 5C.5.2-125, Table 5C.5.2-126).

Flows in the high-flow channel under ESO_ELT and ESO_LLT during January through April would generally be greater than or similar to those under EBC2 ELT and EBC2_LLT, respectively, with few small to moderate flow reductions during some months and water-year types (Table 5C.5.2-123, Table 5C.5.2-124, Figure 5C.5.2-109 through Figure 5C.5.2-112). Compared to the frequent increases in flows during the period, these flow reductions are infrequent enough to have no biologically meaningful effects on steelhead eggs. Further, a very small proportion of the steelhead population spawns in the high-flow channel. Flows in the high-flow channel under HOS and LOS scenarios during the January through April steelhead spawning and egg incubation period would generally be similar to those under ESO with infrequent, low magnitude reductions that would not have a biologically meaningful effect on steelhead (Table 5C.5.2-127, Table 5C.5.2-128).

NMFS has suggested minimum flows in the Feather River high-flow channel at Thermalito Afterbay during above normal and below normal water years (Table 5C.5.2-129). The percentage of years exceeding each minimum are presented in Table 5C.5.2-130 and differences between pairs of model scenarios are presented in Table 5C.5.2-131. These results indicate that there would be few months in which the percentage of years that exceeded these suggested minimum flows under ESO_ELT or ESO_LLT would be lower than the percentage under EBC2_ELT and EBC2_LLT, respectively. During the January through April steelhead spawning period, there would not be any months in which the percentage of years exceeding these minimum flows would be lower under the ESO scenario. Therefore, it was concluded that the effects of the ESO on steelhead spawning and egg incubation habitat in the Feather River would be minimal.

The percentage of years exceeding minimum flows suggested by NMFS are presented in Table 5C.5.2-132 and differences between the ESO scenario and HOS and LOS scenarios are presented in Table 5C.5.2-133. There is a wide range of differences between the ESO scenario and HOS and LOS scenarios depending on month and water year. In general, the HOS scenario was designed to maintain a more natural (i.e., biologically-significant, hydrology-driven) hydrograph than the ESO scenario. Exceedances under HOS during January through May in above normal water years would be higher than those under ESO and exceedances under HOS during June through September would be slightly lower than those under ESO. Exceedances under HOS during October through June in below normal water years would be higher than those under ESO and exceedances under HOS during August and September would be lower than those under ESO. Exceedances during other months not mentioned here would be variable. Exceedances under LOS are too variable between time period and months to describe here. In general, there would be few reductions in exceedances above NMFS suggested flows under LOS relative to ESO.

For steelhead spawning and egg incubation during January through April, exceedances under ESO, HOS, and LOS scenarios would generally be similar to or higher than those under EBC2 with few exceptions (Table 5C.5.2-130, Table 5C.5.2-131, Table 5C.5.2-132, Table 5C.5.2-133). It is not likely that these exceptions would cause a biologically meaningful effect, although there is low certainty in this conclusion.

1 **Table 5C.5.2-121. Mean Monthly Flows (cfs) in the Feather River Low-Flow Channel (above Thermalito**
2 **Afterbay) under EBC and ESO Scenarios**

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	800	800	800	800	800	800
	AN	800	800	800	800	800	800
	BN	800	800	800	800	800	800
	D	800	800	800	800	800	800
	C	800	800	800	800	800	800
	All	800	800	800	800	800	800
Feb	W	800	800	800	800	800	800
	AN	800	800	800	800	800	800
	BN	800	800	800	800	800	800
	D	800	800	800	800	800	800
	C	800	800	800	800	800	800
	All	800	800	800	800	800	800
Mar	W	800	800	800	800	800	800
	AN	800	800	800	800	800	800
	BN	800	800	800	800	800	800
	D	800	800	800	800	800	800
	C	800	800	800	800	800	800
	All	800	800	800	800	800	800
Apr	W	700	700	700	700	700	700
	AN	700	700	700	700	700	700
	BN	700	700	700	700	700	700
	D	700	700	700	700	700	700
	C	700	700	700	700	700	700
	All	700	700	700	700	700	700
May	W	700	700	700	700	700	700
	AN	700	700	700	700	700	700
	BN	700	700	700	700	700	700
	D	700	700	700	700	700	700
	C	700	700	700	700	700	700
	All	700	700	700	700	700	700
Jun	W	700	700	700	700	700	700
	AN	700	700	700	700	700	700
	BN	700	700	700	700	700	700
	D	700	700	700	700	700	700
	C	700	700	700	700	700	700
	All	700	700	700	700	700	700
Jul	W	700	700	700	700	700	700
	AN	700	700	700	700	700	700
	BN	700	700	700	700	700	700
	D	700	700	700	700	700	700
	C	700	700	700	700	700	700
	All	700	700	700	700	700	700

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Aug	W	700	700	700	700	700	700
	AN	700	700	700	700	700	700
	BN	700	700	700	700	700	700
	D	700	700	700	700	700	700
	C	700	700	700	700	700	700
	All	700	700	700	700	700	700
Sep	W	773	773	773	773	773	773
	AN	773	773	773	773	773	773
	BN	773	773	773	773	773	773
	D	773	773	773	773	773	773
	C	773	773	773	773	773	773
	All	773	773	773	773	773	773
Oct	W	800	800	800	800	800	800
	AN	800	800	800	800	800	800
	BN	800	800	800	800	800	800
	D	800	800	800	800	800	800
	C	800	800	800	800	800	800
	All	800	800	800	800	800	800
Nov	W	800	800	800	800	800	800
	AN	800	800	800	800	800	800
	BN	800	800	800	800	800	800
	D	800	800	800	800	800	800
	C	800	800	800	800	800	800
	All	800	800	800	800	800	800
Dec	W	800	800	800	800	800	800
	AN	800	800	800	800	800	800
	BN	800	800	800	800	800	800
	D	800	800	800	800	800	800
	C	800	800	800	800	800	800
	All	800	800	800	800	800	800

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

1 **Table 5C.5.2-122. Differences between EBC and ESO Scenarios in Mean Monthly Flows (cfs) in the**
2 **Feather River Low-Flow Channel (above Thermalito Afterbay)**

Month	Water-Year Type[a]	Scenario[b]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Month	Water-Year Type[a]	Scenario[b]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Aug	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sep	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Oct	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-123. Mean Monthly Flows (cfs) in the Feather River High-Flow Channel at Thermalito Afterbay under EBC and ESO Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	11,257	10,642	11,528	11,896	11,518	11,023
	AN	4,434	3,470	3,419	2,838	3,138	2,874
	BN	2,640	1,703	1,692	1,441	1,411	1,419
	D	1,798	1,448	1,477	1,459	1,527	1,556
	C	1,459	1,222	1,378	1,648	1,359	1,721
	All	5,277	4,669	4,970	4,995	4,886	4,751
Feb	W	12,466	11,548	13,732	14,787	14,169	16,276
	AN	7,411	5,403	5,793	5,809	7,546	6,955
	BN	3,916	2,797	2,280	1,897	2,029	2,145
	D	1,817	1,620	1,642	1,659	1,608	1,636
	C	1,610	1,477	1,467	1,482	1,442	1,516
	All	6,340	5,502	6,166	6,444	6,507	7,126
Mar	W	12,895	12,392	13,977	14,772	13,839	14,401
	AN	7,733	6,950	8,568	8,568	8,860	9,456
	BN	3,373	2,441	2,347	1,985	2,052	1,598
	D	2,017	1,701	1,521	1,762	1,679	1,930
	C	1,697	1,478	1,590	1,634	1,755	1,729
	All	6,487	5,953	6,653	6,902	6,660	6,900
Apr	W	6,472	6,510	6,652	6,408	6,669	6,399
	AN	2,251	2,257	2,240	2,170	2,234	2,180
	BN	1,205	1,119	1,132	1,203	1,131	1,728
	D	1,286	1,328	1,448	1,470	1,653	2,036
	C	1,389	1,375	1,384	1,407	1,608	1,637
	All	3,073	3,078	3,150	3,084	3,233	3,330
May	W	7,528	7,539	6,380	4,740	6,369	5,060
	AN	3,340	3,262	3,342	3,101	4,190	3,929
	BN	1,205	1,149	1,316	1,749	1,479	2,780
	D	1,591	1,586	1,862	2,223	2,120	2,563
	C	1,574	1,520	1,877	1,790	1,694	1,762
	All	3,661	3,635	3,420	3,005	3,599	3,475
Jun	W	5,062	5,139	3,659	4,211	5,427	6,423
	AN	3,301	3,385	3,107	3,930	5,824	7,008
	BN	2,707	2,752	3,153	3,552	6,490	6,365
	D	3,134	3,352	3,432	3,284	4,378	3,790
	C	2,695	2,700	2,812	2,666	2,587	2,648
	All	3,632	3,725	3,318	3,628	5,021	5,368
Jul	W	6,490	6,748	7,835	8,577	7,444	7,849
	AN	8,757	9,113	9,434	9,488	9,550	9,427
	BN	8,981	9,094	8,936	8,833	8,575	7,843
	D	8,294	8,266	7,980	8,099	6,454	5,117
	C	6,703	6,040	6,144	5,217	3,221	2,618
	All	7,674	7,724	8,041	8,157	7,110	6,714

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Aug	W	3,308	3,906	5,462	6,228	4,965	5,037
	AN	6,042	6,384	6,948	7,346	6,639	5,955
	BN	6,295	6,448	6,348	6,868	5,848	5,550
	D	7,036	6,106	5,633	4,990	3,890	3,743
	C	2,613	2,625	2,236	2,163	2,748	2,116
	All	4,935	4,998	5,396	5,634	4,800	4,547
Sep	W	2,280	8,458	8,400	8,327	6,656	7,049
	AN	2,253	7,021	7,172	6,899	5,742	5,142
	BN	2,466	2,710	3,161	3,068	1,824	1,790
	D	2,366	1,999	1,473	1,052	1,194	1,266
	C	1,421	1,529	1,451	1,345	1,814	1,638
	All	2,201	4,835	4,788	4,601	3,790	3,811
Oct	W	3,456	3,204	3,025	3,051	3,243	3,087
	AN	2,386	2,770	2,577	2,741	2,779	3,163
	BN	3,183	2,801	2,820	2,862	3,030	2,895
	D	2,688	2,667	2,786	2,652	3,323	3,101
	C	2,472	2,267	2,233	2,102	2,311	2,656
	All	2,940	2,817	2,756	2,747	3,020	3,006
Nov	W	3,292	2,992	2,812	2,470	2,878	2,391
	AN	1,824	2,003	1,915	2,119	1,916	1,916
	BN	2,101	2,043	1,950	1,900	1,930	1,904
	D	1,859	1,733	1,729	1,664	1,806	1,782
	C	1,854	1,860	1,803	1,876	1,866	1,829
	All	2,349	2,243	2,148	2,058	2,192	2,022
Dec	W	7,157	5,414	5,543	3,948	5,259	4,456
	AN	2,951	3,328	3,344	3,344	3,484	2,864
	BN	2,176	2,515	2,096	2,102	2,140	2,029
	D	2,364	2,343	2,202	2,229	2,366	2,221
	C	2,609	2,152	1,781	1,694	2,025	2,610
	All	3,973	3,462	3,349	2,837	3,358	3,048

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-124. Differences[a] between EBC and ESO Scenarios in Mean Monthly Flows (cfs) in the Feather River High-Flow Channel at Thermalito Afterbay

Month	Water-Year Type[b]	Scenario[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	261 (2%)	-235 (-2%)	877 (8%)	381 (4%)	-9 (-0.1%)	-873 (-7%)
	AN	-1296 (-29%)	-1559 (-35%)	-332 (-10%)	-596 (-17%)	-281 (-8%)	36 (1%)
	BN	-1229 (-47%)	-1221 (-46%)	-292 (-17%)	-284 (-17%)	-282 (-17%)	-22 (-2%)
	D	-272 (-15%)	-242 (-13%)	79 (5%)	108 (7%)	50 (3%)	97 (7%)
	C	-100 (-7%)	262 (18%)	137 (11%)	499 (41%)	-19 (-1%)	73 (4%)
	All	-391 (-7%)	-526 (-10%)	217 (5%)	82 (2%)	-84 (-2%)	-243 (-5%)
Feb	W	1702 (14%)	3810 (31%)	2620 (23%)	4728 (41%)	436 (3%)	1489 (10%)
	AN	135 (2%)	-456 (-6%)	2143 (40%)	1552 (29%)	1753 (30%)	1146 (20%)
	BN	-1887 (-48%)	-1771 (-45%)	-768 (-27%)	-652 (-23%)	-251 (-11%)	248 (13%)
	D	-209 (-11%)	-181 (-10%)	-12 (-1%)	15 (1%)	-34 (-2%)	-23 (-1%)
	C	-169 (-10%)	-94 (-6%)	-35 (-2%)	39 (3%)	-25 (-2%)	34 (2%)
	All	167 (3%)	785 (12%)	1005 (18%)	1624 (30%)	341 (6%)	682 (11%)
Mar	W	944 (7%)	1506 (12%)	1447 (12%)	2009 (16%)	-138 (-1%)	-371 (-3%)
	AN	1128 (15%)	1724 (22%)	1911 (27%)	2506 (36%)	292 (3%)	888 (10%)
	BN	-1322 (-39%)	-1775 (-53%)	-390 (-16%)	-843 (-35%)	-295 (-13%)	-387 (-19%)
	D	-338 (-17%)	-87 (-4%)	-23 (-1%)	228 (13%)	158 (10%)	168 (10%)
	C	58 (3%)	32 (2%)	278 (19%)	251 (17%)	166 (10%)	95 (6%)
	All	173 (3%)	412 (6%)	707 (12%)	947 (16%)	7 (0%)	-3 (0%)
Apr	W	196 (3%)	-73 (-1%)	159 (2%)	-111 (-2%)	17 (0%)	-9 (0%)
	AN	-18 (-1%)	-71 (-3%)	-24 (-1%)	-77 (-3%)	-7 (0%)	10 (0%)
	BN	-74 (-6%)	523 (43%)	12 (1%)	608 (54%)	-1 (0%)	524 (44%)
	D	367 (29%)	750 (58%)	325 (25%)	708 (53%)	205 (14%)	565 (38%)
	C	219 (16%)	248 (18%)	233 (17%)	262 (19%)	224 (16%)	230 (16%)
	All	160 (5%)	257 (8%)	154 (5%)	251 (8%)	82 (3%)	246 (8%)
May	W	-1159 (-15%)	-2468 (-33%)	-1170 (-16%)	-2479 (-33%)	-11 (0%)	320 (7%)
	AN	850 (25%)	590 (18%)	928 (28%)	668 (20%)	848 (25%)	828 (27%)
	BN	274 (23%)	1575 (131%)	331 (29%)	1631 (142%)	163 (12%)	1032 (59%)
	D	529 (33%)	972 (61%)	534 (34%)	977 (62%)	259 (14%)	340 (15%)
	C	120 (8%)	187 (12%)	175 (11%)	242 (16%)	-183 (-10%)	-28 (-2%)
	All	-63 (-2%)	-187 (-5%)	-36 (-1%)	-160 (-4%)	179 (5%)	469 (16%)
Jun	W	365 (7%)	1361 (27%)	288 (6%)	1284 (25%)	1767 (48%)	2212 (53%)
	AN	2523 (76%)	3707 (112%)	2439 (72%)	3623 (107%)	2717 (87%)	3079 (78%)
	BN	3783 (140%)	3658 (135%)	3738 (136%)	3613 (131%)	3337 (106%)	2813 (79%)
	D	1244 (40%)	656 (21%)	1026 (31%)	439 (13%)	946 (28%)	506 (15%)
	C	-108 (-4%)	-47 (-2%)	-113 (-4%)	-52 (-2%)	-225 (-8%)	-18 (-1%)
	All	1388 (38%)	1736 (48%)	1295 (35%)	1643 (44%)	1702 (51%)	1741 (48%)
Jul	W	954 (15%)	1359 (21%)	696 (10%)	1101 (16%)	-391 (-5%)	-728 (-8%)
	AN	793 (9%)	670 (8%)	437 (5%)	314 (3%)	116 (1%)	-61 (-1%)
	BN	-406 (-5%)	-1138 (-13%)	-519 (-6%)	-1251 (-14%)	-361 (-4%)	-989 (-11%)
	D	-1840 (-22%)	-3177 (-38%)	-1812 (-22%)	-3149 (-38%)	-1526 (-19%)	-2981 (-37%)
	C	-3482 (-52%)	-4085 (-61%)	-2819 (-47%)	-3423 (-57%)	-2923 (-48%)	-2599 (-50%)
	All	-564 (-7%)	-960 (-13%)	-614 (-8%)	-1010 (-13%)	-931 (-12%)	-1444 (-18%)

Month	Water-Year Type[b]	Scenario[c] EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Aug	W	1657 (50%)	1729 (52%)	1059 (27%)	1131 (29%)	-497 (-9%)	-1191 (-19%)
	AN	596 (10%)	-87 (-1%)	255 (4%)	-429 (-7%)	-309 (-4%)	-1391 (-19%)
	BN	-447 (-7%)	-745 (-12%)	-600 (-9%)	-898 (-14%)	-500 (-8%)	-1318 (-19%)
	D	-3147 (-45%)	-3294 (-47%)	-2216 (-36%)	-2363 (-39%)	-1743 (-31%)	-1248 (-25%)
	C	134 (5%)	-497 (-19%)	123 (5%)	-509 (-19%)	512 (23%)	-47 (-2%)
	All	-135 (-3%)	-388 (-8%)	-198 (-4%)	-451 (-9%)	-596 (-11%)	-1087 (-19%)
Sep	W	4376 (192%)	4769 (209%)	-1802 (-21%)	-1409 (-17%)	-1744 (-21%)	-1278 (-15%)
	AN	3490 (155%)	2889 (128%)	-1279 (-18%)	-1879 (-27%)	-1429 (-20%)	-1757 (-25%)
	BN	-642 (-26%)	-675 (-27%)	-886 (-33%)	-920 (-34%)	-1337 (-42%)	-1278 (-42%)
	D	-1171 (-50%)	-1100 (-46%)	-805 (-40%)	-734 (-37%)	-279 (-19%)	214 (20%)
	C	394 (28%)	218 (15%)	286 (19%)	109 (7%)	363 (25%)	294 (22%)
	All	1589 (72%)	1610 (73%)	-1045 (-22%)	-1024 (-21%)	-998 (-21%)	-791 (-17%)
Oct	W	-213 (-6%)	-369 (-11%)	40 (1%)	-117 (-4%)	218 (7%)	36 (1%)
	AN	393 (16%)	776 (33%)	9 (0.3%)	393 (14%)	202 (8%)	422 (15%)
	BN	-153 (-5%)	-288 (-9%)	229 (8%)	95 (3%)	210 (7%)	34 (1%)
	D	635 (24%)	413 (15%)	656 (25%)	434 (16%)	537 (19%)	449 (17%)
	C	-161 (-7%)	184 (7%)	44 (2%)	389 (17%)	77 (3%)	554 (26%)
	All	80 (3%)	65 (2%)	204 (7%)	189 (7%)	264 (10%)	258 (9%)
Nov	W	-415 (-13%)	-902 (-27%)	-114 (-4%)	-601 (-20%)	66 (2%)	-79 (-3%)
	AN	92 (5%)	92 (5%)	-87 (-4%)	-87 (-4%)	1 (0.04%)	-203 (-10%)
	BN	-171 (-8%)	-197 (-9%)	-113 (-6%)	-139 (-7%)	-20 (-1%)	4 (0.2%)
	D	-53 (-3%)	-78 (-4%)	73 (4%)	48 (3%)	77 (4%)	117 (7%)
	C	12 (1%)	-25 (-1%)	6 (0.3%)	-31 (-2%)	63 (4%)	-47 (-3%)
	All	-157 (-7%)	-327 (-14%)	-51 (-2%)	-221 (-10%)	44 (2%)	-35 (-2%)
Dec	W	-1898 (-27%)	-2701 (-38%)	-155 (-3%)	-958 (-18%)	-284 (-5%)	508 (13%)
	AN	534 (18%)	-87 (-3%)	156 (5%)	-464 (-14%)	140 (4%)	-480 (-14%)
	BN	-36 (-2%)	-147 (-7%)	-375 (-15%)	-486 (-19%)	43 (2%)	-73 (-3%)
	D	2 (0.1%)	-142 (-6%)	23 (1%)	-122 (-5%)	164 (7%)	-8 (-0.4%)
	C	-584 (-22%)	2 (0.1%)	-127 (-6%)	458 (21%)	244 (14%)	916 (54%)
	All	-615 (-15%)	-925 (-23%)	-104 (-3%)	-414 (-12%)	10 (0%)	211 (7%)

[a] Positive values indicate greater flow under ESO than under EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

1

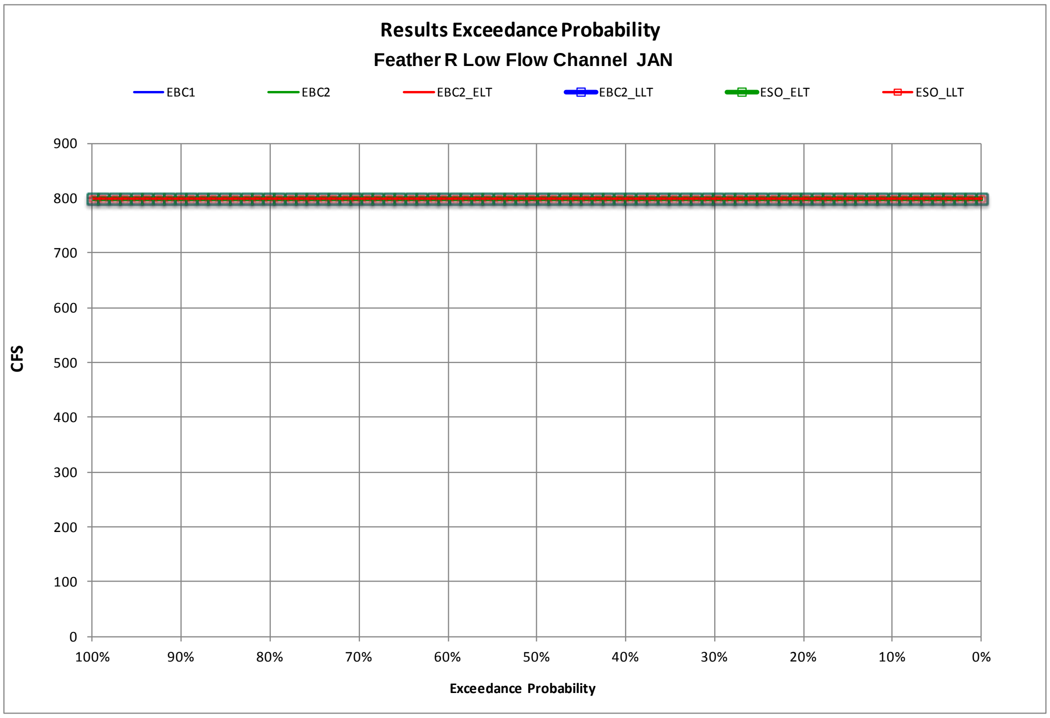


Figure 5C.5.2-97. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River Low-Flow Channel (above Thermalito Afterbay), January

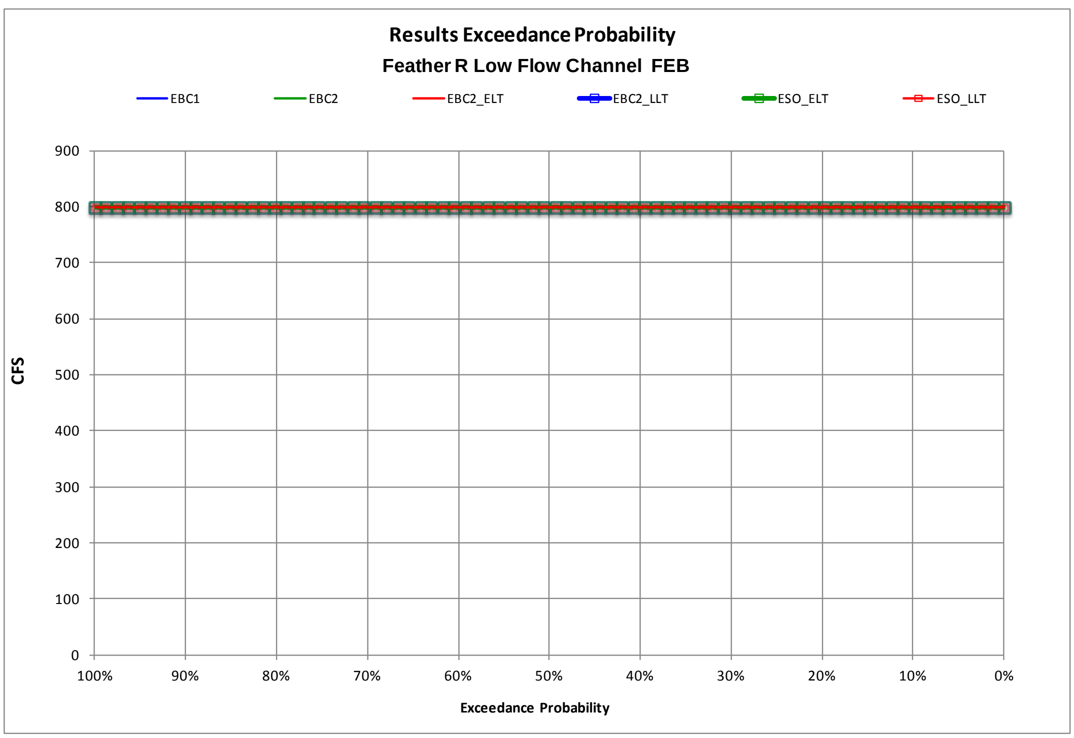


Figure 5C.5.2-98. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River Low-Flow Channel (above Thermalito Afterbay), February

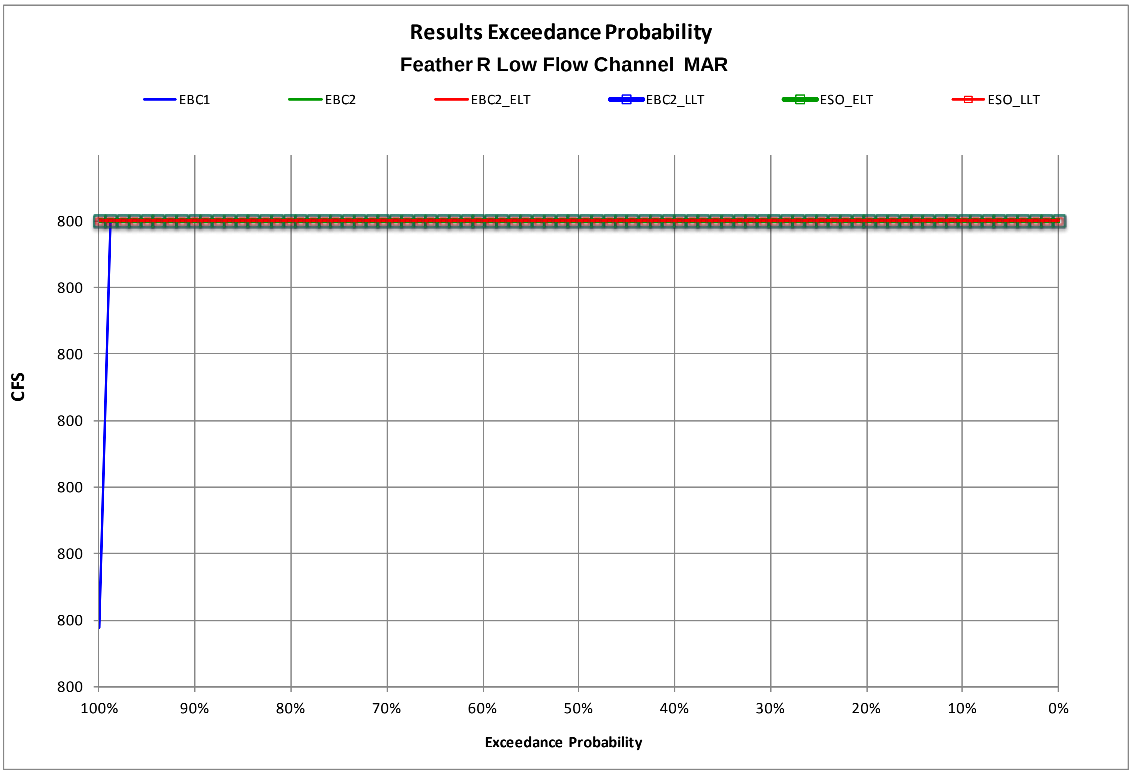


Figure 5C.5.2-99. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River Low-Flow Channel (above Thermalito Afterbay), March

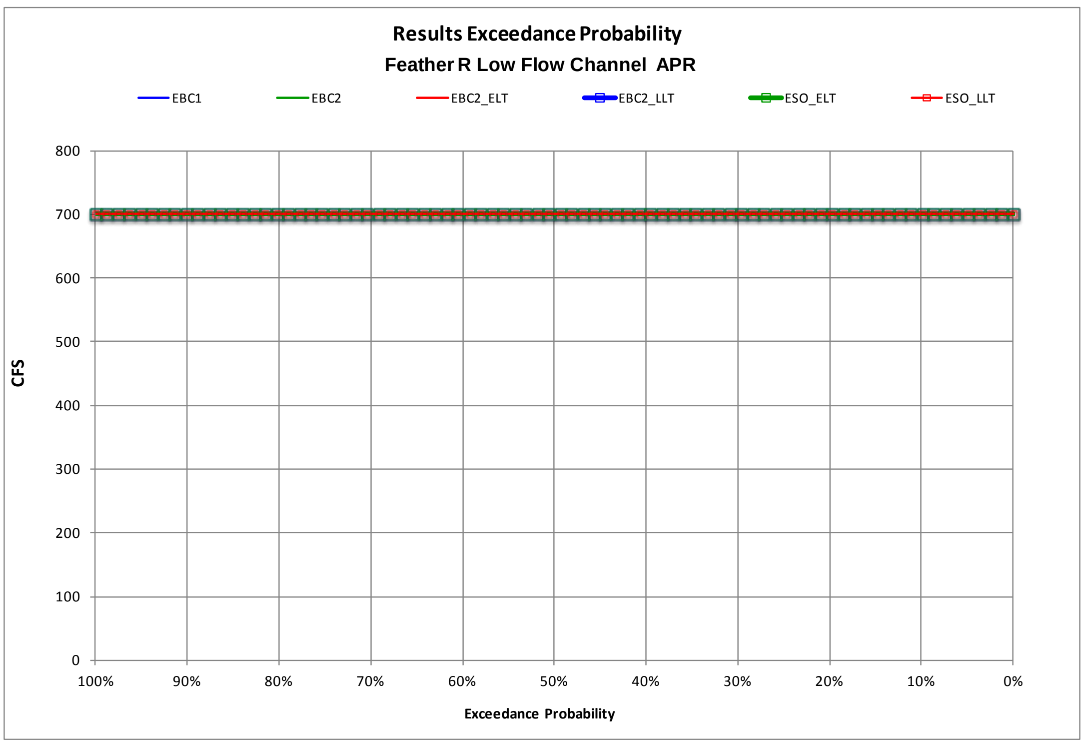


Figure 5C.5.2-100. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River Low-Flow Channel (above Thermalito Afterbay), April

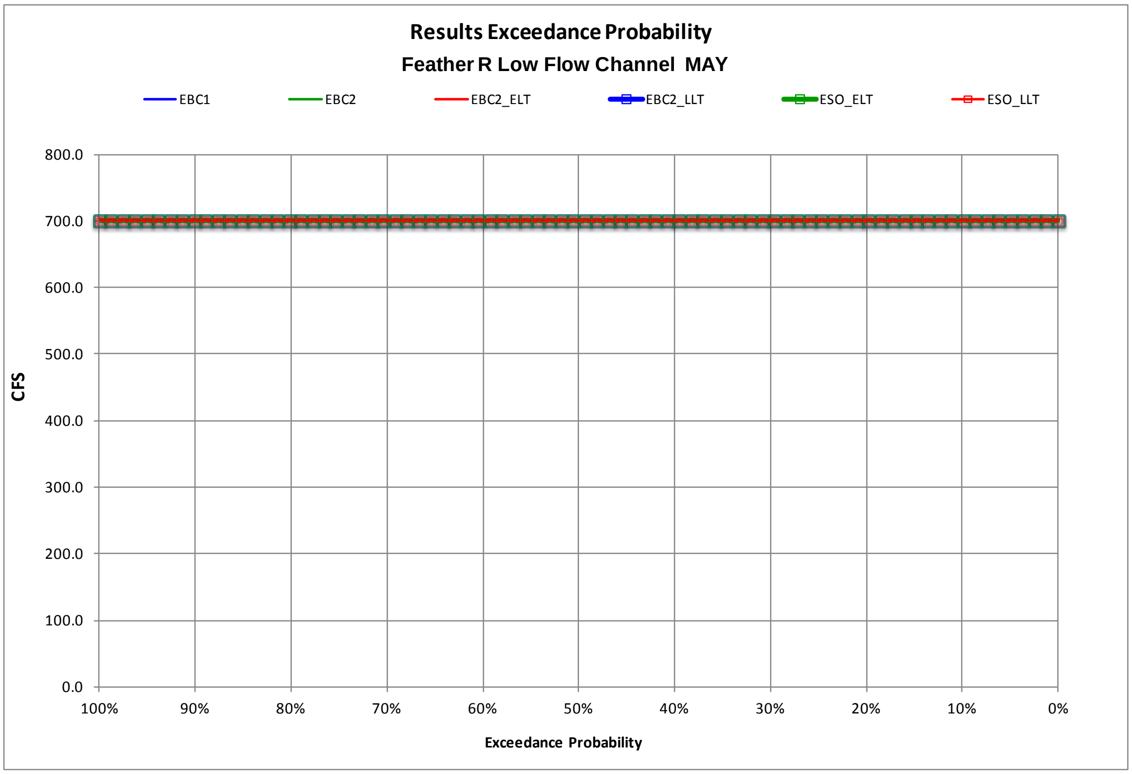


Figure 5C.5.2-101. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River Low-Flow Channel (above Thermalito Afterbay), May

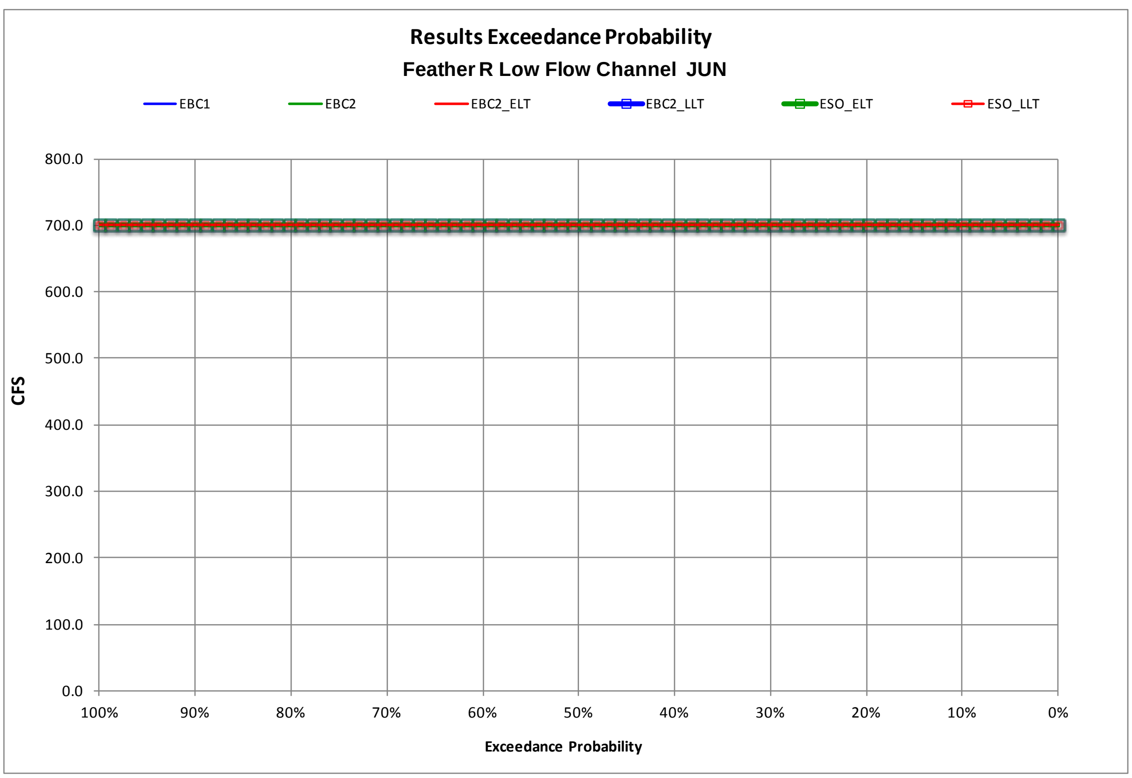


Figure 5C.5.2-102. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River Low-Flow Channel (above Thermalito Afterbay), June

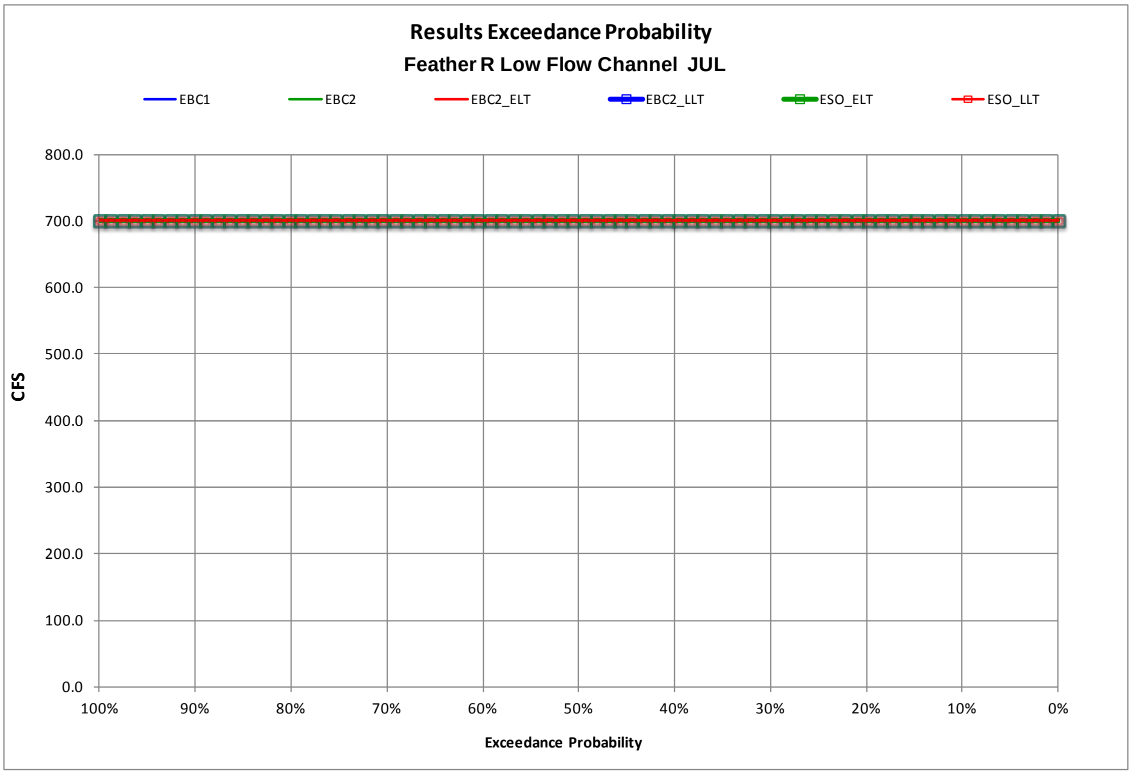


Figure 5C.5.2-103. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River Low-Flow Channel (above Thermalito Afterbay), July

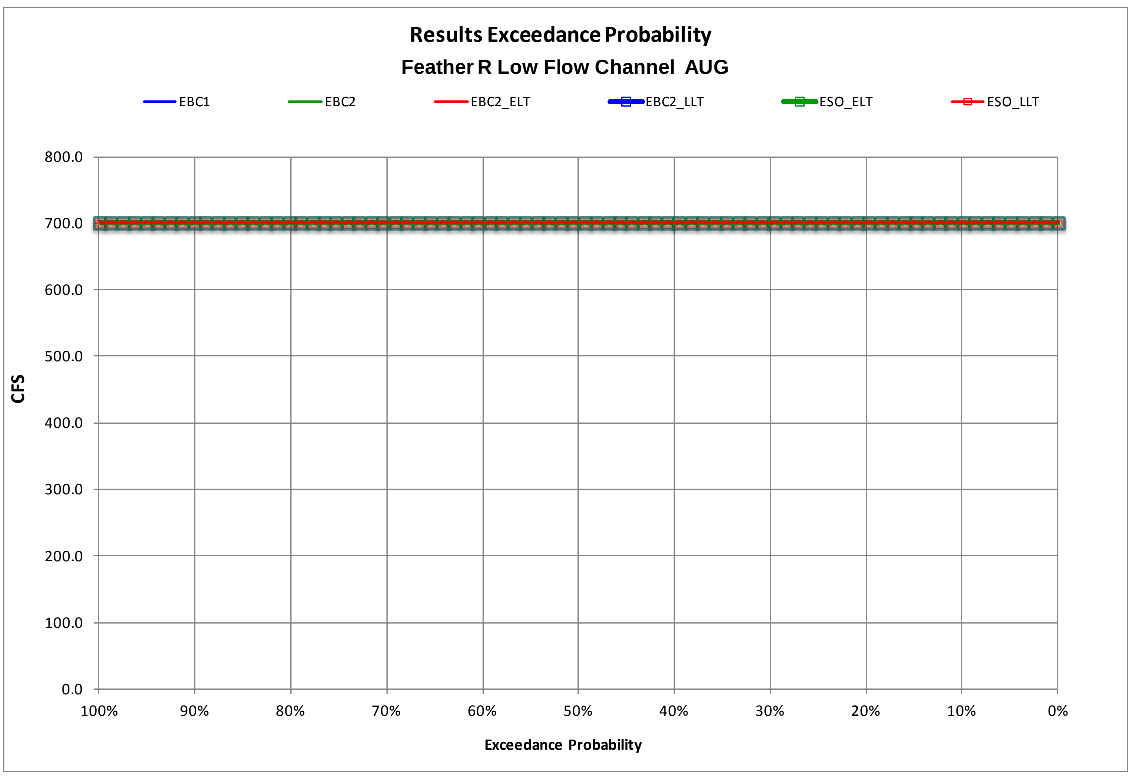


Figure 5C.5.2-104. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River Low-Flow Channel (above Thermalito Afterbay), August

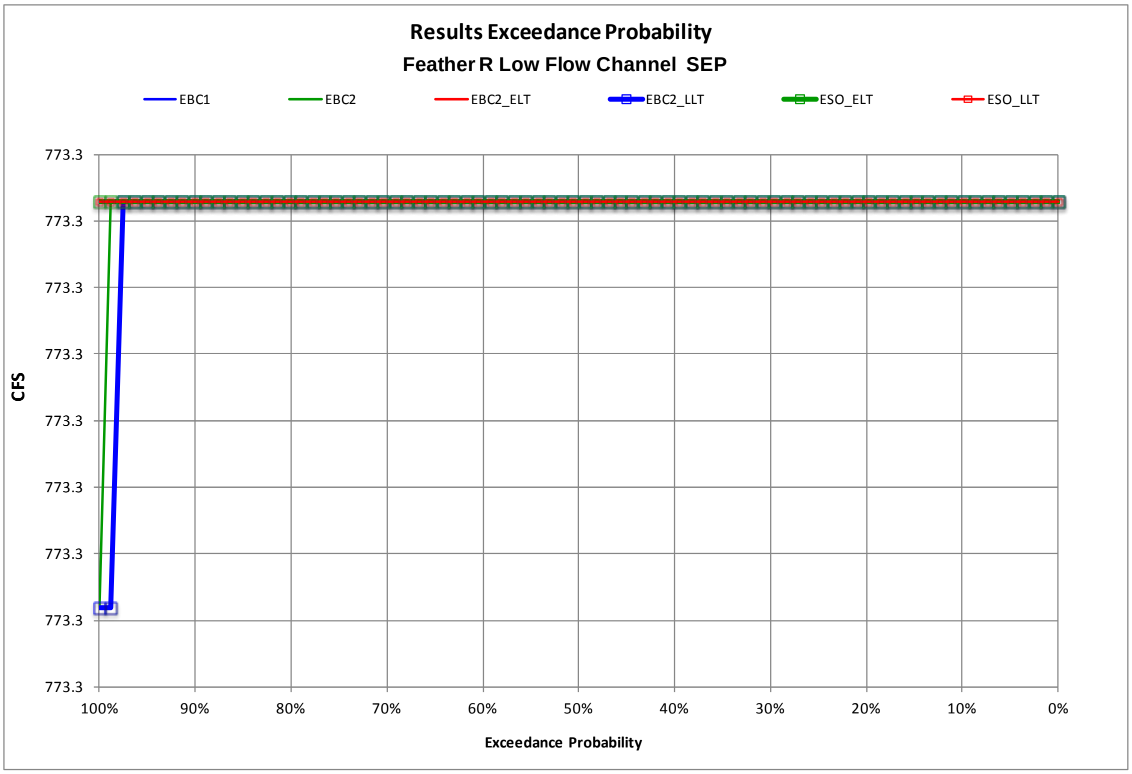


Figure 5C.5.2-105. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River Low-Flow Channel (above Thermalito Afterbay), September

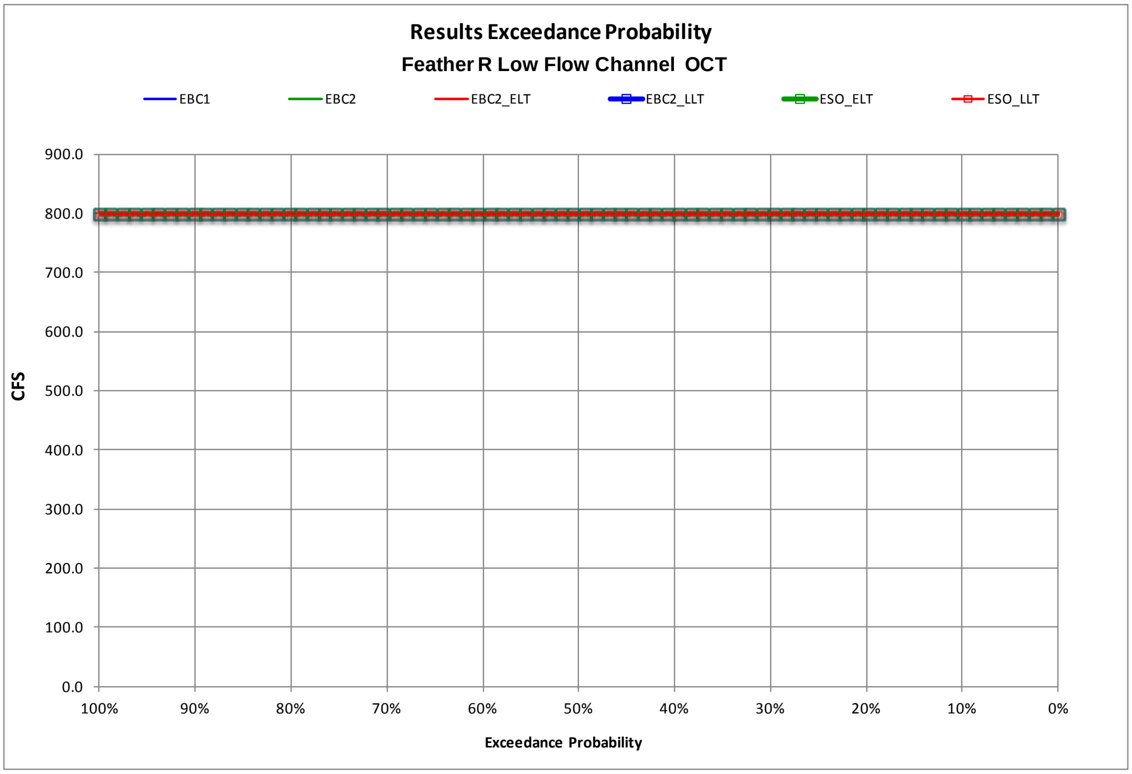


Figure 5C.5.2-106. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River Low-Flow Channel (above Thermalito Afterbay), October

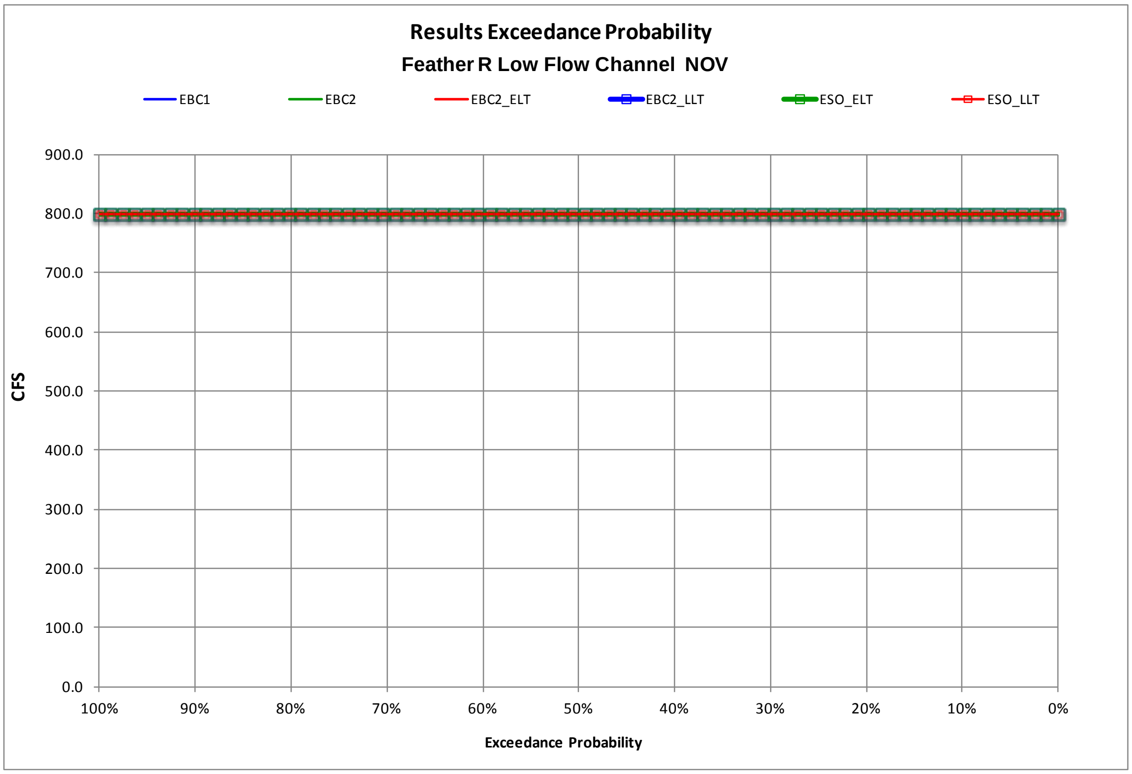


Figure 5C.5.2-107. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River Low-Flow Channel (above Thermalito Afterbay), November

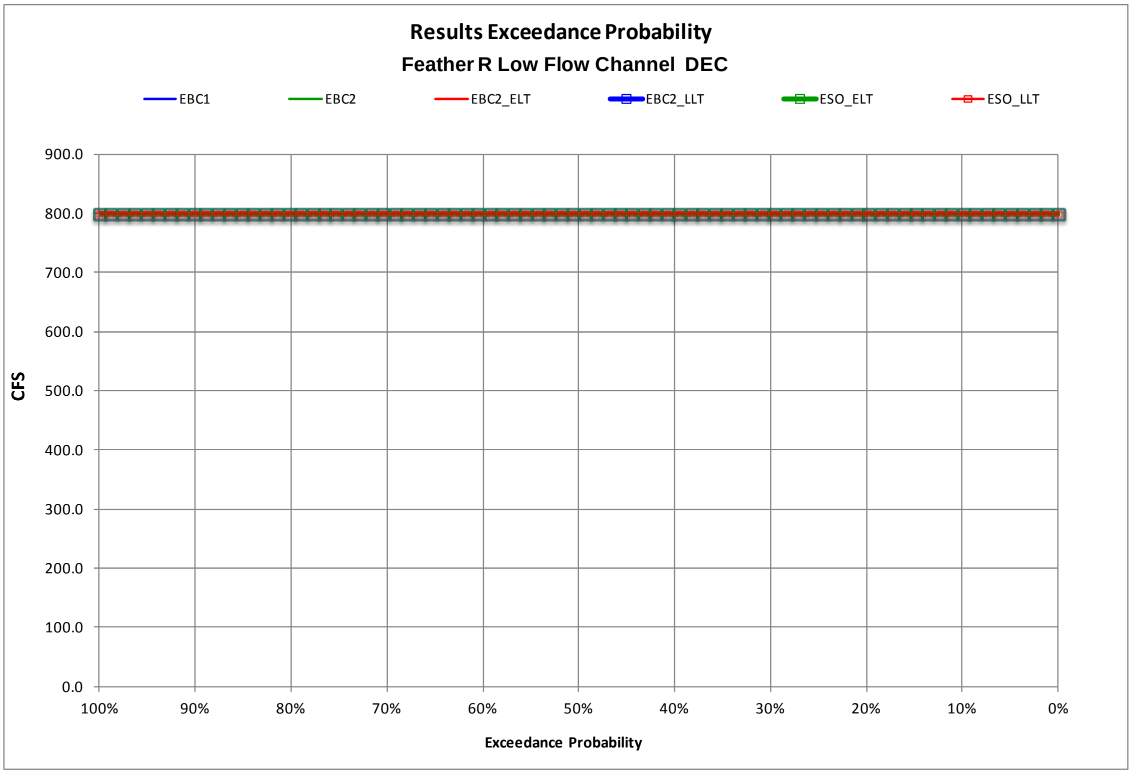


Figure 5C.5.2-108. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River Low-Flow Channel (above Thermalito Afterbay, December

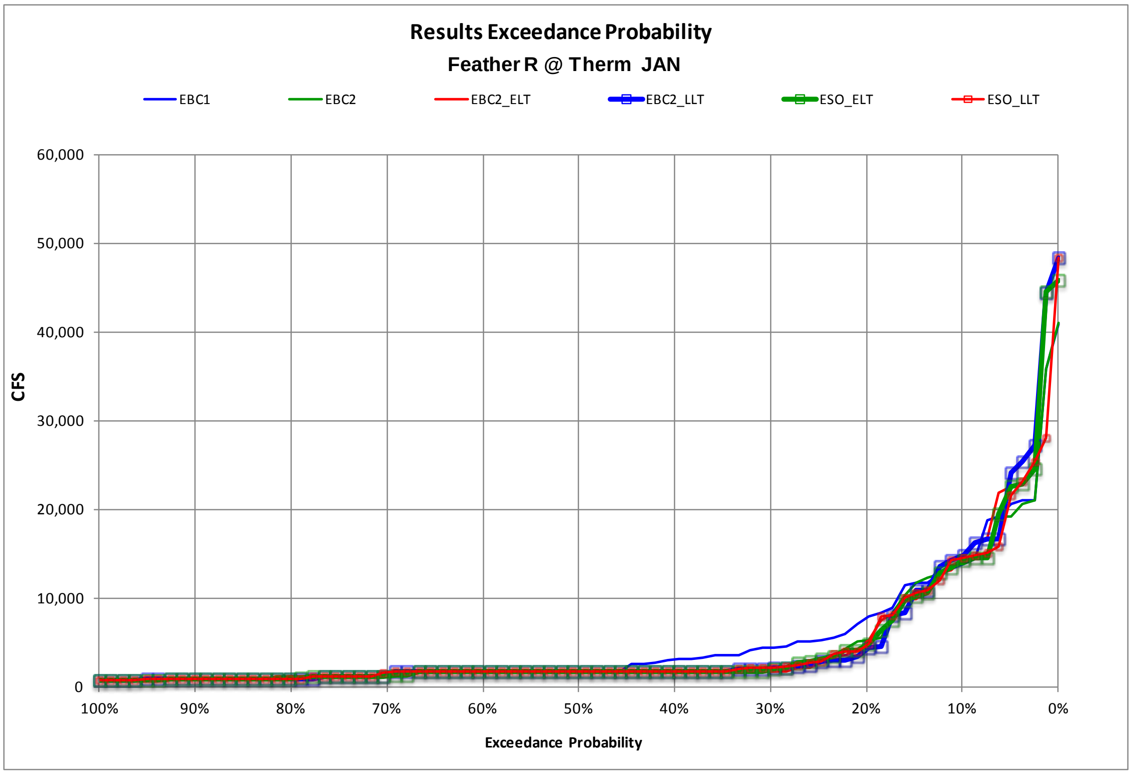


Figure 5C.5.2-109. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River High-Flow Channel at Thermalito Afterbay, January

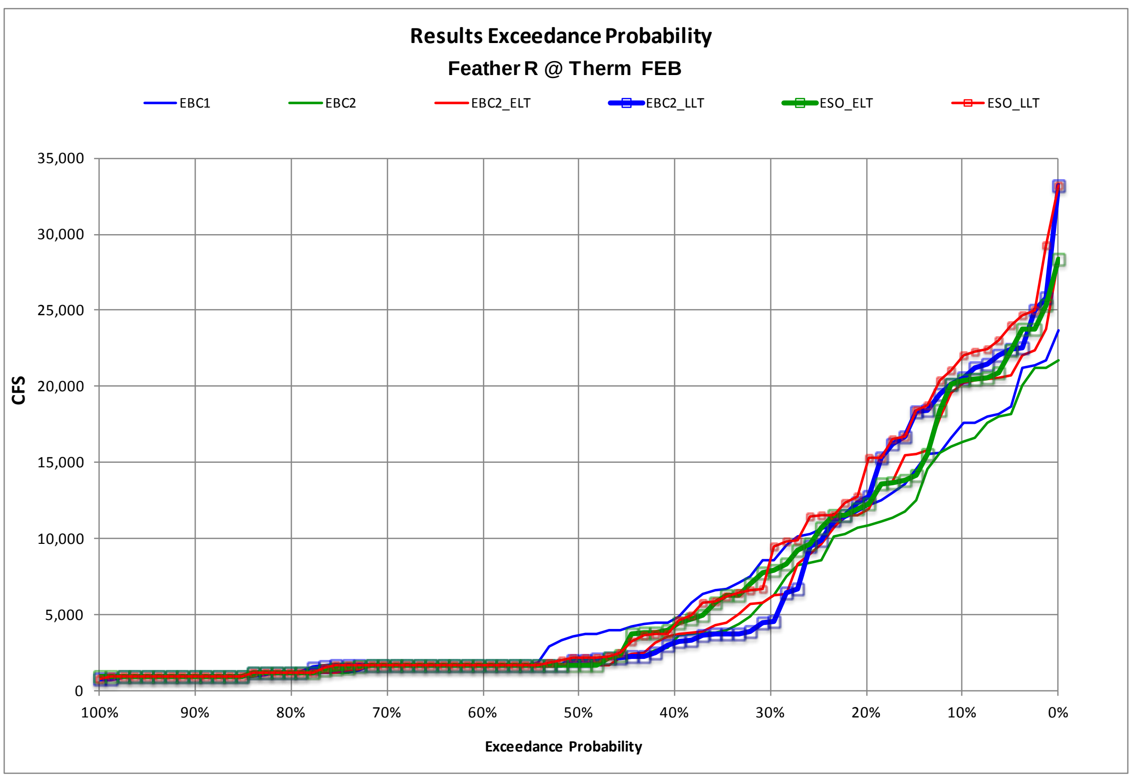


Figure 5C.5.2-110. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River High-Flow Channel at Thermalito Afterbay, February

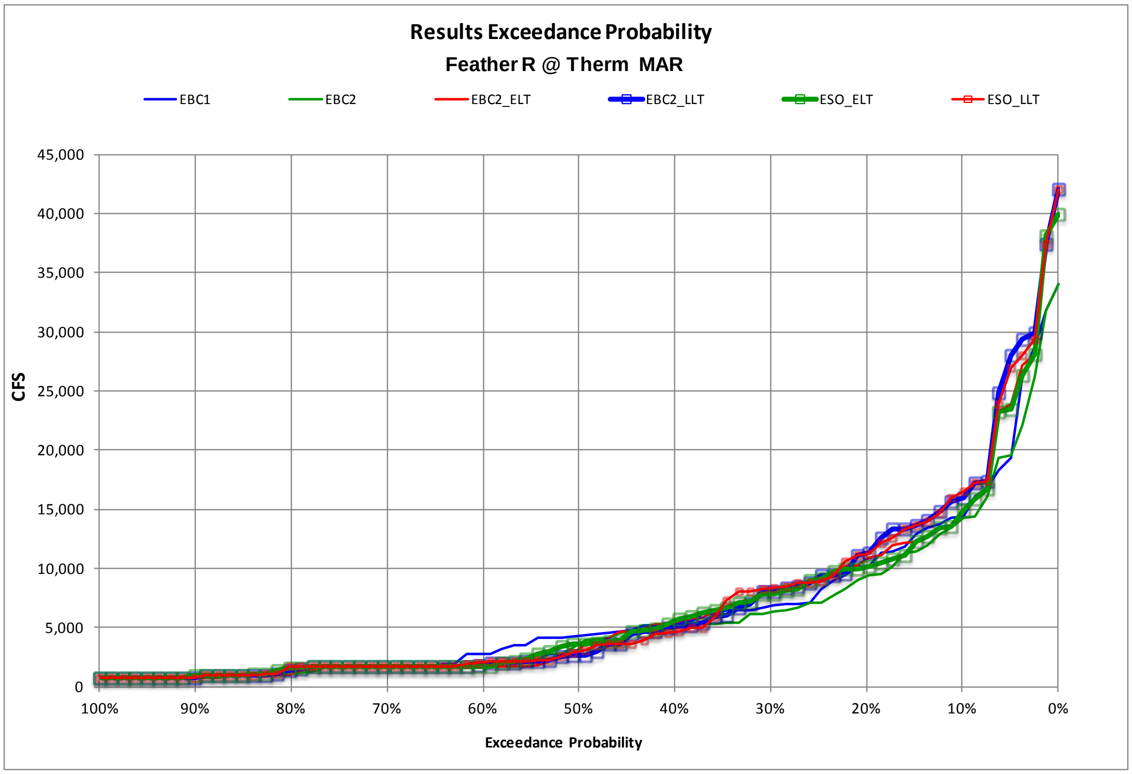


Figure 5C.5.2-111. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River High-Flow Channel at Thermalito Afterbay, March

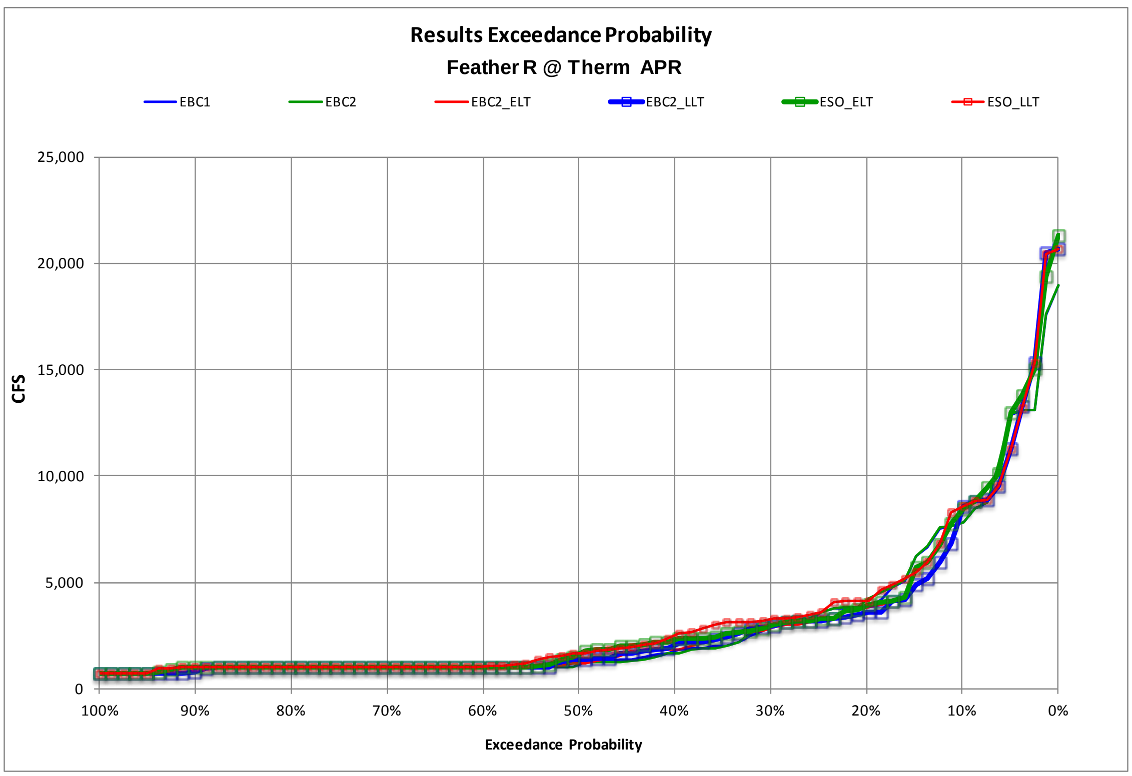


Figure 5C.5.2-112. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River High-Flow Channel at Thermalito Afterbay, April

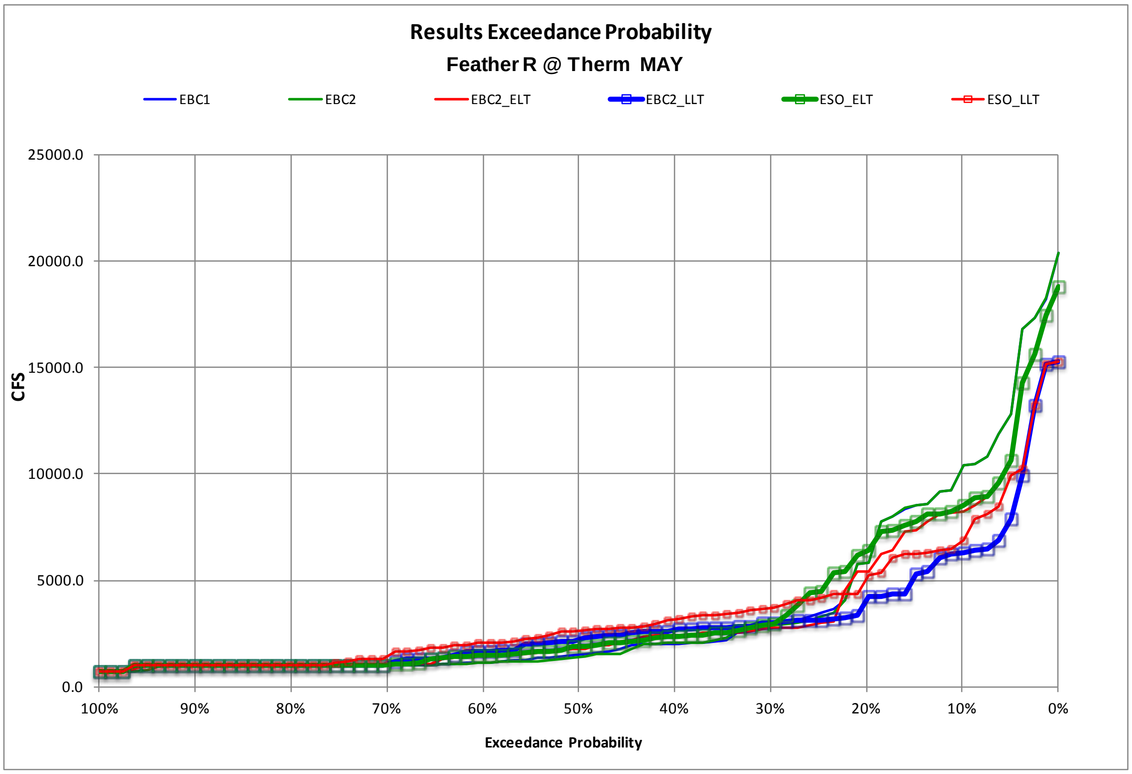


Figure 5C.5.2-113. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River High-Flow Channel at Thermalito Afterbay, May

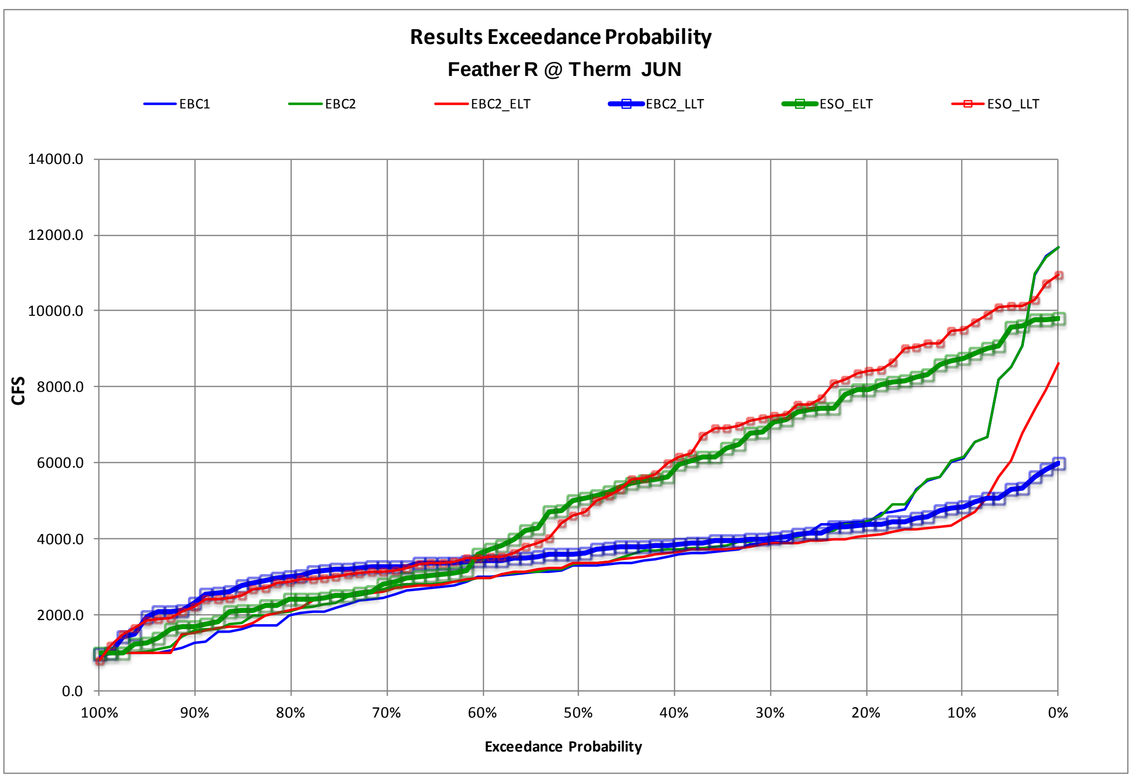


Figure 5C.5.2-114. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River High-Flow Channel at Thermalito Afterbay, June

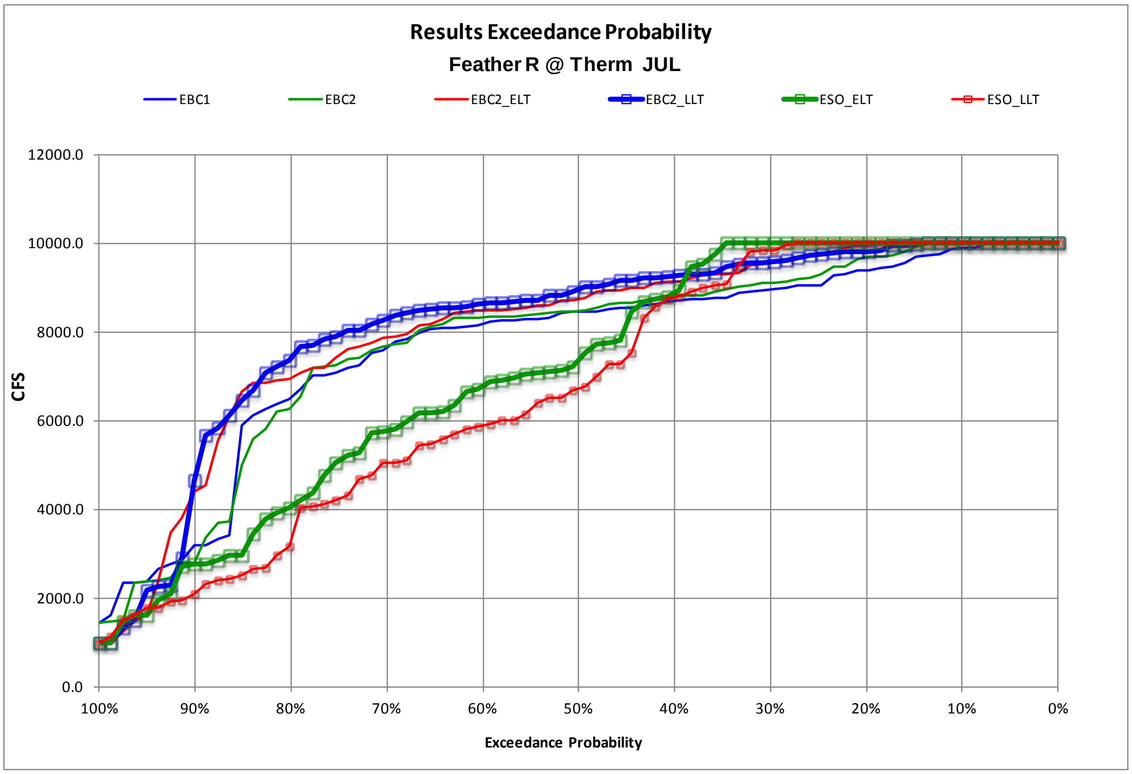


Figure 5C.5.2-115. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River High-Flow Channel at Thermalito Afterbay, July

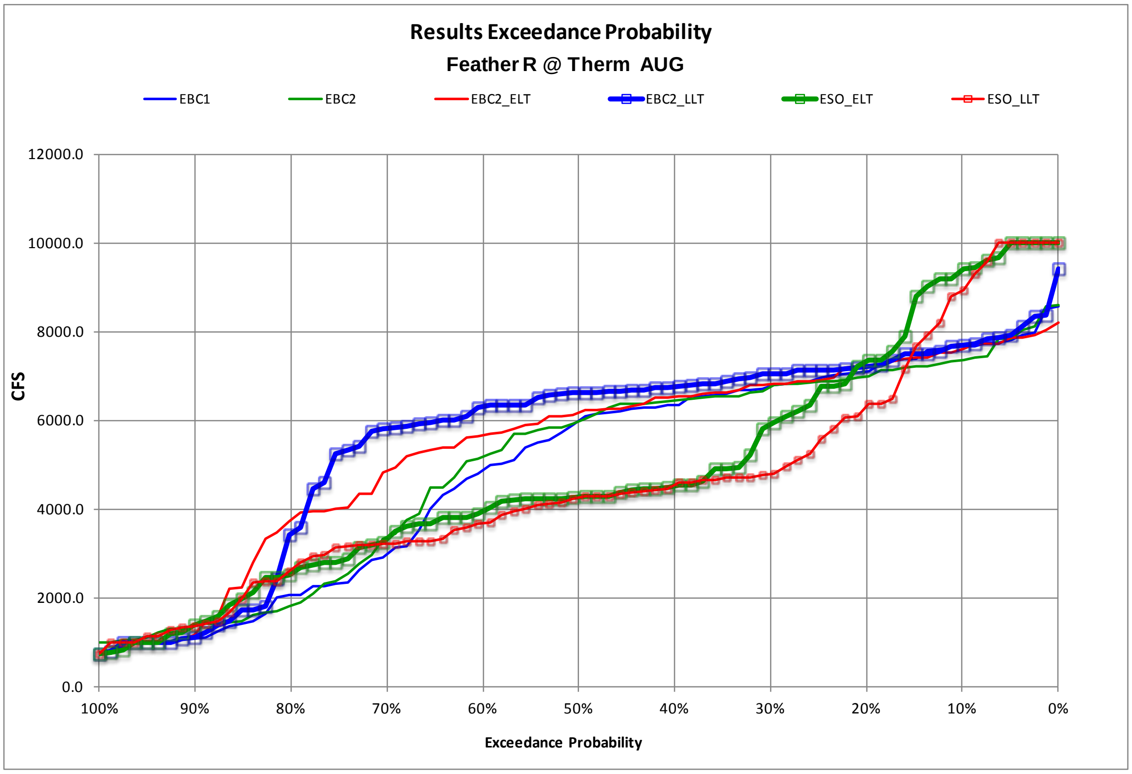


Figure 5C.5.2-116. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River High-Flow Channel at Thermalito Afterbay, August

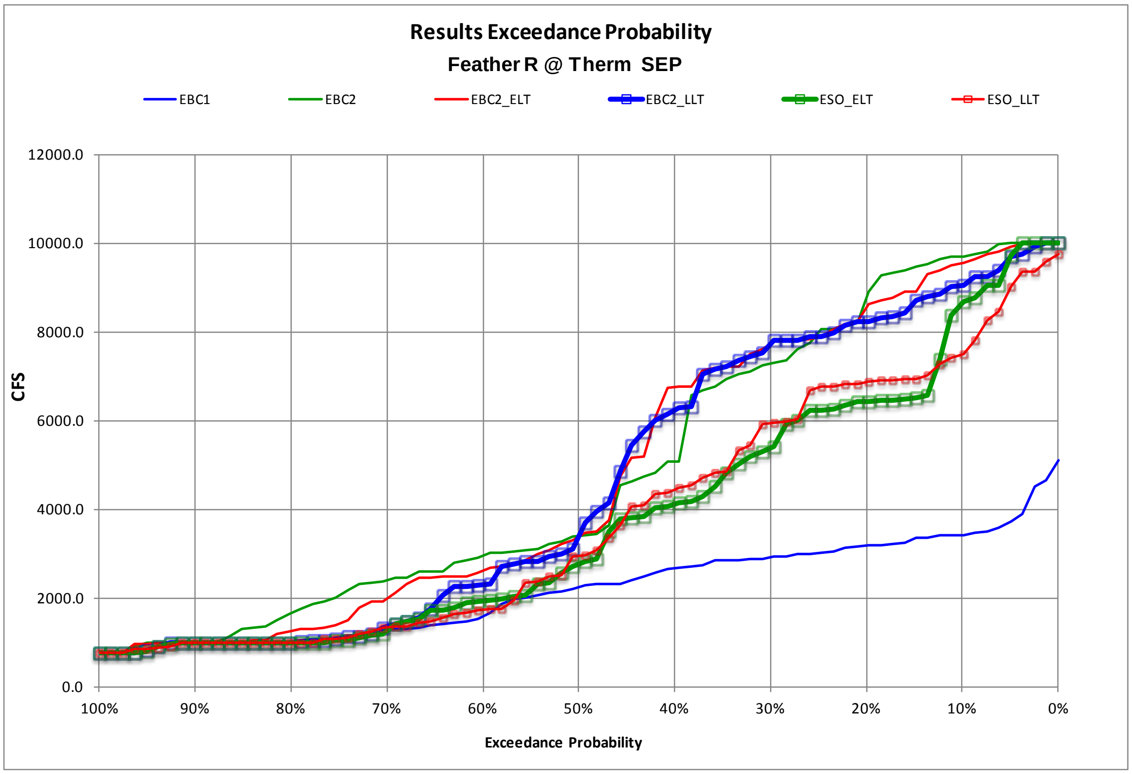


Figure 5C.5.2-117. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River High-Flow Channel at Thermalito Afterbay, September

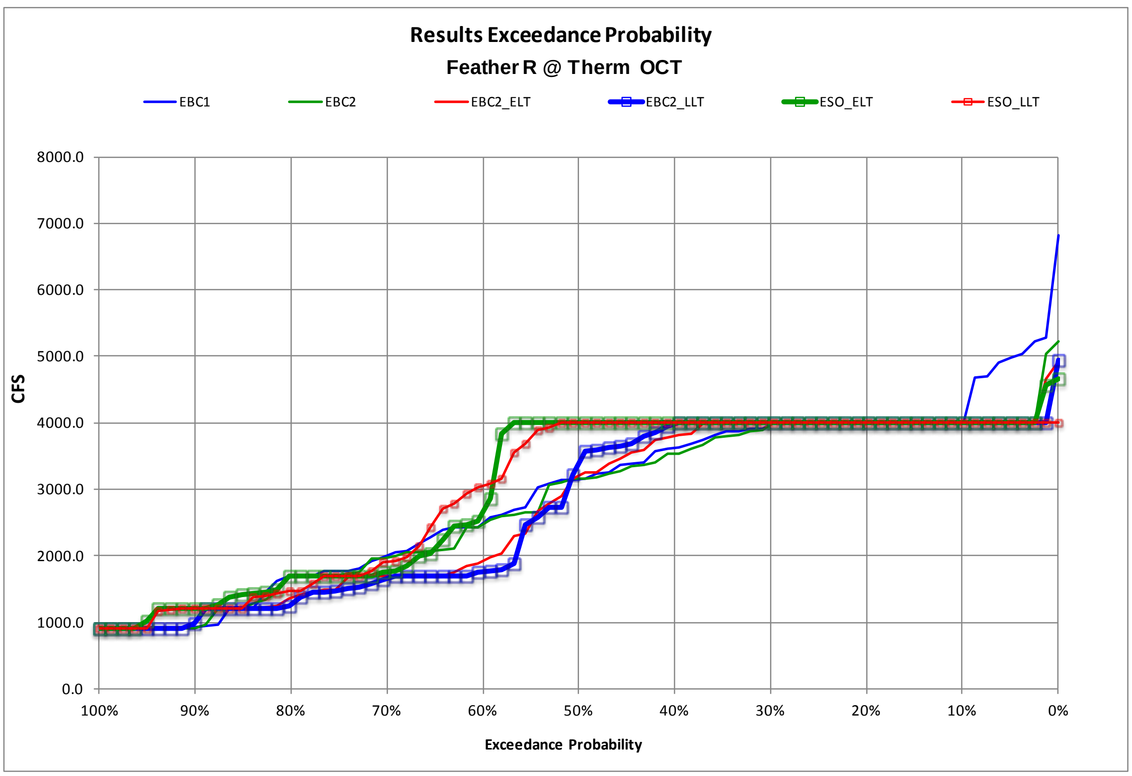


Figure 5C.5.2-118. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River High-Flow Channel at Thermalito Afterbay, October

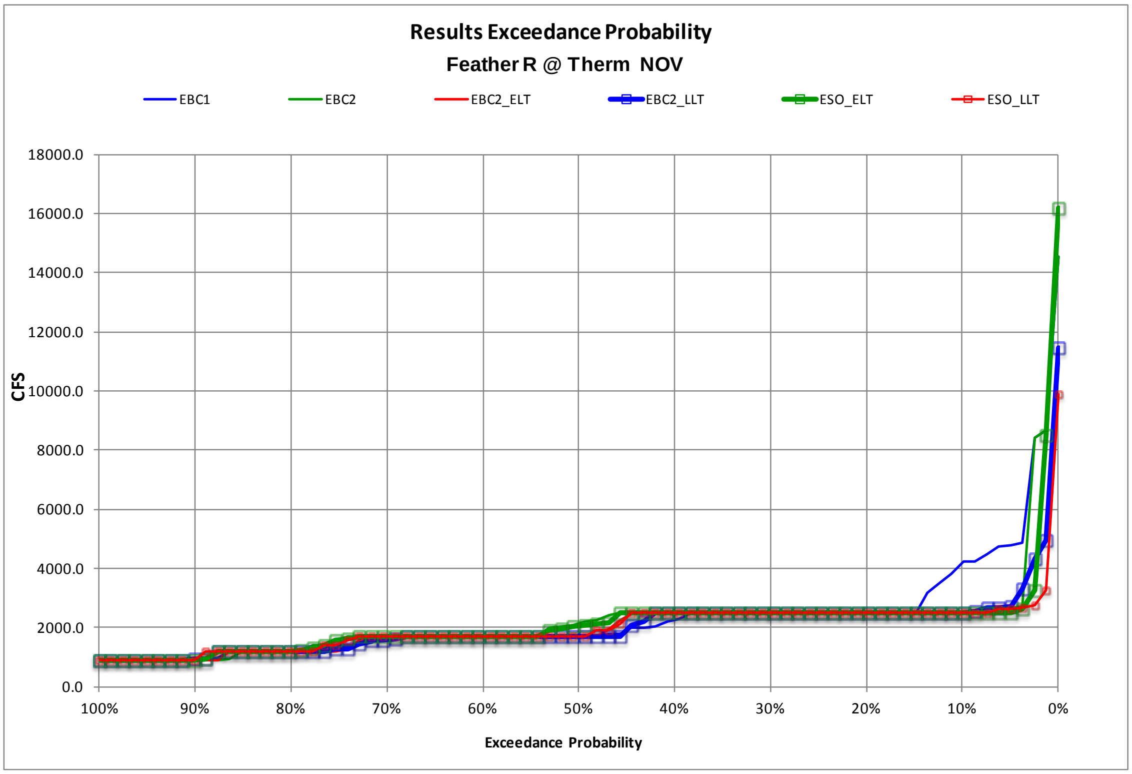


Figure 5C.5.2-119. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River High-Flow Channel at Thermalito Afterbay, November

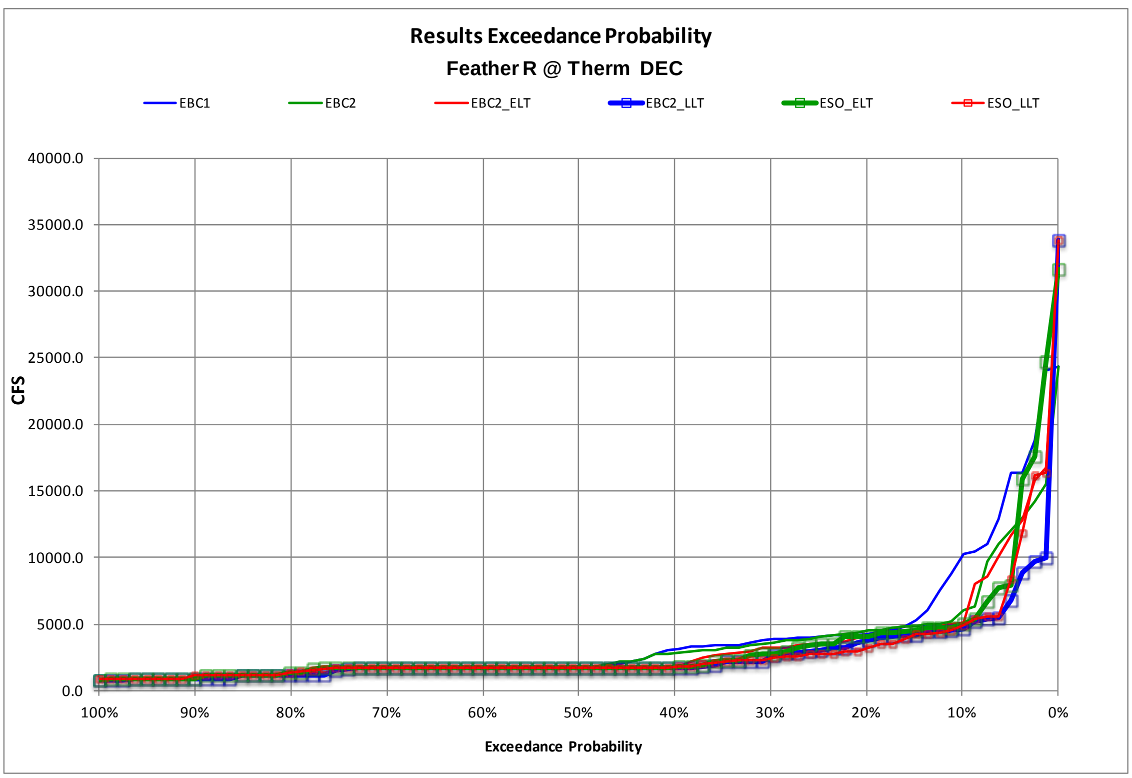


Figure 5C.5.2-120. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River High-Flow Channel at Thermalito Afterbay, December

Table 5C.5.2-125. Mean Monthly Flows (cfs) in the Feather River Low-Flow Channel (above Thermalito Afterbay) for ESO, HOS, and LOS Scenarios

Month	Water-Year Type[a]	Scenario[b] ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	800	800	800	800	800	800
	AN	800	800	800	800	800	800
	BN	800	800	800	800	800	800
	D	800	800	800	800	800	800
	C	800	800	800	800	800	800
	All	800	800	800	800	800	800
Feb	W	800	800	800	800	800	800
	AN	800	800	800	800	800	800
	BN	800	800	800	800	800	800
	D	800	800	800	800	800	800
	C	800	800	800	800	800	800
	All	800	800	800	800	800	800
Mar	W	800	800	800	800	800	800
	AN	800	800	800	800	800	800
	BN	800	800	800	800	800	800
	D	800	800	800	800	800	800
	C	800	800	800	800	800	800
	All	800	800	800	800	800	800
Apr	W	700	700	700	700	700	700
	AN	700	700	700	700	700	700
	BN	700	700	700	700	700	700
	D	700	700	700	700	700	700
	C	700	700	700	700	700	700
	All	700	700	700	700	700	700
May	W	700	700	700	700	700	700
	AN	700	700	700	700	700	700
	BN	700	700	700	700	700	700
	D	700	700	700	700	700	700
	C	700	700	700	700	700	700
	All	700	700	700	700	700	700
Jun	W	700	700	700	700	700	700
	AN	700	700	700	700	700	700
	BN	700	700	700	700	700	700
	D	700	700	700	700	700	700
	C	700	700	700	700	700	700
	All	700	700	700	700	700	700
Jul	W	700	700	700	700	700	700
	AN	700	700	700	700	700	700
	BN	700	700	700	700	700	700
	D	700	700	700	700	700	700
	C	700	700	700	700	700	700
	All	700	700	700	700	700	700

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Aug	W	700	700	700	699	700	700
	AN	700	700	700	697	700	700
	BN	700	700	700	700	700	700
	D	700	700	700	700	700	700
	C	700	700	700	679	700	700
	All	700	700	700	696	700	700
Sep	W	773	773	773	773	773	773
	AN	773	773	773	773	773	773
	BN	773	773	773	773	773	773
	D	773	773	772	772	773	773
	C	773	773	773	773	773	773
	All	773	773	773	773	773	773
Oct	W	800	800	800	800	800	800
	AN	800	800	800	800	800	800
	BN	800	800	800	800	800	800
	D	800	800	800	800	800	800
	C	800	800	800	800	800	800
	All	800	800	800	800	800	800
Nov	W	800	800	800	800	800	800
	AN	800	800	800	800	800	800
	BN	800	800	800	800	800	800
	D	800	800	800	800	800	800
	C	800	800	800	800	800	800
	All	800	800	800	800	800	800
Dec	W	800	800	800	800	800	800
	AN	800	800	800	800	800	800
	BN	800	800	800	800	800	800
	D	800	800	800	800	800	800
	C	800	800	800	800	800	800
	All	800	800	800	800	800	800

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-126. Differences[a] between ESO Scenarios and HOS and LOS Scenarios in Mean Monthly Flows (cfs) in the Feather River Low-Flow Channel (above Thermalito Afterbay)

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	0 (0%)	-1 (-0.2%)	0 (0%)	0 (0%)
	AN	0 (0%)	-3 (-0.4%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	-21 (-2.9%)	0 (0%)	0 (0%)
	All	0 (0%)	-4 (-0.6%)	0 (0%)	0 (0%)
Sep	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	-1 (-0.2%)	-1 (-0.2%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Oct	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)

[a] Negative value indicates lower flow under HOS or LOS than under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

1 **Table 5C.5.2-127. Mean Monthly Flows (cfs) in the Feather River High-Flow Channel at Thermalito**
2 **Afterbay for ESO, HOS, and LOS Scenarios**

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	11,518	11,023	11,948	12,105	12,831	13,569
	AN	3,138	2,874	4,093	3,687	3,700	3,673
	BN	1,411	1,419	1,685	1,602	1,686	1,387
	D	1,527	1,556	1,454	1,521	1,634	1,802
	C	1,359	1,721	1,314	1,620	2,354	1,691
	All	4,886	4,751	5,187	5,222	5,601	5,720
Feb	W	14,169	16,276	13,400	15,221	14,118	16,167
	AN	7,546	6,955	6,549	7,555	8,440	7,609
	BN	2,029	2,145	3,192	2,760	3,099	2,763
	D	1,608	1,636	1,582	1,551	1,604	1,676
	C	1,442	1,516	1,487	1,496	1,490	1,404
	All	6,507	7,126	6,317	6,962	6,811	7,285
Mar	W	13,839	14,401	13,841	14,794	14,178	14,854
	AN	8,860	9,456	8,934	8,466	9,324	10,269
	BN	2,052	1,598	2,647	2,140	2,503	2,061
	D	1,679	1,930	1,795	1,796	1,775	1,955
	C	1,755	1,729	1,718	1,766	1,671	1,759
	All	6,660	6,900	6,794	6,948	6,922	7,251
Apr	W	6,669	6,399	9,926	9,774	6,646	6,402
	AN	2,234	2,180	5,926	5,997	2,233	2,280
	BN	1,131	1,728	7,335	7,436	1,262	1,762
	D	1,653	2,036	1,872	2,097	1,596	2,134
	C	1,608	1,637	1,445	1,471	1,652	1,731
	All	3,233	3,330	5,889	5,922	3,242	3,386
May	W	6,369	5,060	9,392	7,908	6,369	5,021
	AN	4,190	3,929	7,125	5,979	3,826	3,914
	BN	1,479	2,780	3,993	3,581	1,470	2,526
	D	2,120	2,563	2,337	2,646	2,066	2,638
	C	1,694	1,762	1,737	1,783	1,744	1,779
	All	3,599	3,475	5,470	4,836	3,539	3,436
Jun	W	5,427	6,423	3,204	3,916	5,456	6,031
	AN	5,824	7,008	3,783	4,501	5,825	6,963
	BN	6,490	6,365	4,249	4,731	7,002	6,303
	D	4,378	3,790	3,569	3,319	4,614	3,875
	C	2,587	2,648	2,538	2,607	2,693	2,582
	All	5,021	5,368	3,450	3,818	5,185	5,236
Jul	W	7,444	7,849	6,030	6,348	7,384	7,629
	AN	9,550	9,427	6,325	5,855	9,488	9,241
	BN	8,575	7,843	7,167	6,486	8,227	7,746
	D	6,454	5,117	5,476	4,690	7,029	5,551
	C	3,221	2,618	3,939	3,235	3,251	2,933
	All	7,110	6,714	5,839	5,480	7,153	6,742

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Aug	W	4,965	5,037	2,931	3,362	4,738	5,025
	AN	6,639	5,955	3,853	3,976	6,730	5,930
	BN	5,848	5,550	4,498	3,898	6,230	5,739
	D	3,890	3,743	3,240	3,119	4,304	4,257
	C	2,748	2,116	3,306	2,728	2,709	2,066
	All	4,800	4,547	3,456	3,397	4,892	4,678
Sep	W	6,656	7,049	6,075	6,453	1,331	1,208
	AN	5,742	5,142	4,103	4,094	2,772	2,318
	BN	1,824	1,790	1,265	1,219	1,738	1,670
	D	1,194	1,266	1,258	1,541	1,486	1,713
	C	1,814	1,638	2,203	2,495	1,581	1,875
	All	3,790	3,811	3,341	3,557	1,682	1,658
Oct	W	3,243	3,087	2,767	2,782	3,337	3,243
	AN	2,779	3,163	2,609	2,917	3,121	3,287
	BN	3,030	2,895	2,776	2,990	2,817	2,950
	D	3,323	3,101	2,507	2,272	3,157	2,970
	C	2,311	2,656	2,483	3,172	2,663	2,887
	All	3,020	3,006	2,647	2,782	3,078	3,087
Nov	W	2,878	2,391	2,748	2,485	2,701	2,790
	AN	1,916	1,916	1,739	1,883	1,825	1,906
	BN	1,930	1,904	1,793	1,885	1,862	1,873
	D	1,806	1,782	1,625	1,678	1,750	1,796
	C	1,866	1,829	2,025	2,052	2,050	1,837
	All	2,192	2,022	2,085	2,054	2,126	2,146
Dec	W	5,259	4,456	6,450	5,222	6,879	5,293
	AN	3,484	2,864	3,499	3,012	3,489	3,361
	BN	2,140	2,029	1,966	1,948	1,994	2,616
	D	2,366	2,221	2,173	2,090	2,223	2,062
	C	2,025	2,610	1,833	1,967	2,304	2,622
	All	3,358	3,048	3,638	3,175	3,857	3,453

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

1 **Table 5C.5.2-128. Differences[a] between ESO Scenarios and HOS and LOS Scenarios in Flows (cfs) in the**
2 **Feather River High-Flow Channel at Thermalito Afterbay**

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	429 (4%)	1082 (10%)	1313 (11%)	2547 (23%)
	AN	955 (30%)	812 (28%)	562 (18%)	798 (28%)
	BN	275 (19%)	183 (13%)	275 (20%)	-32 (-2%)
	D	-72 (-5%)	-35 (-2%)	108 (7%)	246 (16%)
	C	-45 (-3%)	-101 (-6%)	995 (73%)	-30 (-2%)
	All	300 (6%)	471 (10%)	715 (15%)	969 (20%)
Feb	W	-768 (-5%)	-1055 (-6%)	-50 (0.4%)	-109 (-1%)
	AN	-997 (-13%)	600 (9%)	894 (12%)	654 (9%)
	BN	1163 (57%)	615 (29%)	1070 (53%)	618 (29%)
	D	-26 (-2%)	-85 (-5%)	-4 (0.2%)	40 (2%)
	C	45 (3%)	-20 (-1%)	48 (3%)	-112 (-7%)
	All	-190 (-3%)	-163 (-2%)	304 (5%)	159 (2%)
Mar	W	2 (0%)	392 (3%)	340 (2%)	453 (3%)
	AN	74 (1%)	-990 (-10%)	463 (5%)	812 (9%)
	BN	595 (29%)	542 (34%)	451 (22%)	463 (29%)
	D	117 (7%)	-134 (-7%)	96 (6%)	25 (1%)
	C	-37 (-2%)	37 (2%)	-84 (-5%)	31 (2%)
	All	133 (2%)	48 (1%)	261 (4%)	351 (5%)
Apr	W	3257 (49%)	3375 (53%)	-23 (0%)	2 (0%)
	AN	3692 (165%)	3817 (175%)	0 (0%)	100 (5%)
	BN	6204 (548%)	5708 (330%)	131 (12%)	35 (2%)
	D	219 (13%)	62 (3%)	-57 (-3%)	98 (5%)
	C	-163 (-10%)	-166 (-10%)	44 (3%)	94 (6%)
	All	2657 (82%)	2592 (78%)	9 (0.3%)	57 (2%)
May	W	3023 (47%)	2848 (56%)	0 (0%)	-39 (-1%)
	AN	2935 (70%)	2050 (52%)	-364 (-9%)	-16 (0.4%)
	BN	2514 (170%)	801 (29%)	-9 (-1%)	-254 (-9%)
	D	217 (10%)	83 (3%)	-54 (-3%)	75 (3%)
	C	43 (3%)	21 (1%)	49 (3%)	17 (1%)
	All	1871 (52%)	1361 (39%)	-59 (-2%)	-39 (-1%)
Jun	W	-2222 (-41%)	-2507 (-39%)	30 (1%)	-392 (-6%)
	AN	-2041 (-35%)	-2508 (-36%)	1 (0.01%)	-45 (-1%)
	BN	-2241 (-35%)	-1634 (-26%)	512 (8%)	-62 (-1%)
	D	-809 (-18%)	-471 (-12%)	236 (5%)	85 (2%)
	C	-49 (-2%)	-41 (-2%)	106 (4%)	-66 (-3%)
	All	-1571 (-31%)	-1550 (-29%)	164 (3%)	-133 (-2%)
Jul	W	-1414 (-19%)	-1501 (-19%)	-60 (-1%)	-220 (-3%)
	AN	-3225 (-34%)	-3572 (-38%)	-62 (-1%)	-186 (-2%)
	BN	-1408 (-16%)	-1357 (-17%)	-348 (-4%)	-97 (-1%)
	D	-978 (-15%)	-428 (-8%)	576 (9%)	433 (8%)
	C	718 (22%)	617 (24%)	30 (1%)	315 (12%)
	All	-1270 (-18%)	-1234 (-18%)	43 (1%)	28 (0.4%)

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	-2034 (-41%)	-1675 (-33%)	-227 (-5%)	-12 (0.2%)
	AN	-2786 (-42%)	-1979 (-33%)	91 (1%)	-25 (0.4%)
	BN	-1350 (-23%)	-1651 (-30%)	382 (7%)	189 (3%)
	D	-650 (-17%)	-623 (-17%)	415 (11%)	514 (14%)
	C	558 (20%)	613 (29%)	-39 (-1%)	-50 (-2%)
	All	-1344 (-28%)	-1150 (-25%)	92 (2%)	130 (3%)
Sep	W	-581 (-9%)	-597 (-8%)	-5325 (-80%)	-5841 (-83%)
	AN	-1640 (-29%)	-1048 (-20%)	-2970 (-52%)	-2824 (-55%)
	BN	-559 (-31%)	-571 (-32%)	-86 (-5%)	-120 (-7%)
	D	63 (5%)	276 (22%)	291 (24%)	447 (35%)
	C	388 (21%)	857 (52%)	-233 (-13%)	237 (14%)
	All	-449 (-12%)	-254 (-7%)	-2108 (-56%)	-2153 (-56%)
Oct	W	-476 (-15%)	-305 (-10%)	93 (3%)	156 (5%)
	AN	-171 (-6%)	-246 (-8%)	342 (12%)	124 (4%)
	BN	-255 (-8%)	94 (3%)	-213 (-7%)	54 (2%)
	D	-816 (-25%)	-829 (-27%)	-166 (-5%)	-131 (-4%)
	C	173 (7%)	517 (19%)	352 (15%)	231 (9%)
	All	-373 (-12%)	-223 (-7%)	58 (2%)	82 (3%)
Nov	W	-130 (-5%)	94 (4%)	-176 (-6%)	399 (17%)
	AN	-176 (-9%)	-33 (-2%)	-91 (-5%)	-11 (-1%)
	BN	-137 (-7%)	-20 (-1%)	-68 (-4%)	-31 (-2%)
	D	-181 (-10%)	-104 (-6%)	-57 (-3%)	14 (1%)
	C	159 (9%)	223 (12%)	184 (10%)	9 (0.5%)
	All	-107 (-5%)	32 (2%)	-66 (-3%)	124 (6%)
Dec	W	1191 (23%)	766 (17%)	1620 (31%)	837 (19%)
	AN	14 (0.4%)	147 (5%)	4 (0.1%)	497 (17%)
	BN	-174 (-8%)	-81 (-4%)	-146 (-7%)	587 (29%)
	D	-193 (-8%)	-132 (-6%)	-143 (-6%)	-159 (-7%)
	C	-193 (-10%)	-644 (-25%)	279 (14%)	11 (0.4%)
	All	280 (8%)	128 (4%)	499 (15%)	405 (13%)

[a] Positive values indicate higher flows under HOS or LOS than under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-129. Minimum Flows (cfs)Suggested by NMFS for the Feather River High-Flow Channel at Thermalito Afterbay in Above Normal and Below Normal Water Years

Month	Above Normal Water Years	Below Normal Water Years
October	1700	1500
November	1700	1500
December	3500	2000
January	3500	2000
February	3500	2000
March*	8800	5900
April*	9700	8100
May*	8000	6500
June	2000	2000
July	2000	1500
August	2000	1500
September	1700	1500

[a] Determined by NMFS using predicted inflow and storage constraint.

Table 5C.5.2-130. Percentage of Years Exceeding NMFS Suggested Minimum Flows in the Feather River High-Flow Channel at Thermalito Afterbay under EBC and ESO Scenarios

Month	Scenario[a]					
	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Above Normal						
October	72.7	81.8	72.7	72.7	72.7	72.7
November	72.7	81.8	72.7	72.7	72.7	72.7
December	18.2	27.3	36.4	45.5	27.3	27.3
January	45.5	27.3	18.2	18.2	27.3	18.2
February	63.6	54.5	63.6	63.6	72.7	63.6
March	36.4	27.3	45.5	36.4	45.5	45.5
April	0.0	0.0	0.0	0.0	0.0	0.0
May	9.1	9.1	9.1	9.1	18.2	18.2
June	72.7	72.7	81.8	90.9	81.8	90.9
July	100.0	100.0	100.0	100.0	100.0	100.0
August	90.9	100.0	100.0	100.0	100.0	100.0
September	63.6	100.0	100.0	100.0	100.0	100.0
Below Normal						
October	84.6	76.9	69.2	76.9	69.2	76.9
November	76.9	76.9	69.2	69.2	69.2	69.2
December	28.6	42.9	21.4	28.6	21.4	28.6
January	42.9	7.1	7.1	14.3	7.1	7.1
February	42.9	21.4	21.4	28.6	28.6	28.6
March	21.4	7.1	7.1	7.1	7.1	0.0
April	0.0	0.0	0.0	0.0	0.0	7.1
May	0.0	0.0	0.0	0.0	0.0	7.1
June	64.3	64.3	71.4	92.9	85.7	92.9
July	100.0	100.0	100.0	100.0	100.0	100.0
August	100.0	100.0	100.0	100.0	100.0	100.0
September	78.6	92.9	100.0	92.9	50.0	42.9

[a] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-131. Differences[a] between EBC and ESO Scenarios in the Percentage of Years Exceeding NMFS Suggested Minimum Flows in the Feather River High-Flow Channel at Thermalito Afterbay

Month	Scenarios[b]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Above Normal						
October	0 (0%)	0 (0%)	-9.1 (-11.1%)	-9.1 (-11.1%)	0 (0%)	0 (0%)
November	0 (0%)	0 (0%)	-9.1 (-11.1%)	-9.1 (-11.1%)	0 (0%)	0 (0%)
December	9.1 (50%)	9.1 (50%)	0 (0%)	0 (0%)	-9.1 (-25%)	-18.2 (-40%)
January	-18.2 (-40%)	-27.3 (-60%)	0 (0%)	-9.1 (-33.3%)	9.1 (50%)	0 (0%)
February	9.1 (14.3%)	0 (0%)	18.2 (33.4%)	9.1 (16.7%)	9.1 (14.3%)	0 (0%)
March	9.1 (25%)	9.1 (25%)	18.2 (66.7%)	18.2 (66.7%)	0 (0%)	9.1 (25%)
April	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
May	9.1 (100%)	9.1 (100%)	9.1 (100%)	9.1 (100%)	9.1 (100%)	9.1 (100%)
June	9.1 (12.5%)	18.2 (25%)	9.1 (12.5%)	18.2 (25%)	0 (0%)	0 (0%)
July	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
August	9.1 (10%)	9.1 (10%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
September	36.4 (57.2%)	36.4 (57.2%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Below Normal						
October	-15.4 (-18.2%)	-7.7 (-9.1%)	-7.7 (-10%)	0 (0%)	0 (0%)	0 (0%)
November	-7.7 (-10%)	-7.7 (-10%)	-7.7 (-10%)	-7.7 (-10%)	0 (0%)	0 (0%)
December	-7.2 (-25.2%)	0 (0%)	-21.5 (-50.1%)	-14.3 (-33.3%)	0 (0%)	0 (0%)
January	-35.8 (-83.4%)	-35.8 (-83.4%)	0 (0%)	0 (0%)	0 (0%)	-7.2 (-50.3%)
February	-14.3 (-33.3%)	-14.3 (-33.3%)	7.2 (33.6%)	7.2 (33.6%)	7.2 (33.6%)	0 (0%)
March	-14.3 (-66.8%)	-21.4 (-100%)	0 (0%)	-7.1 (-100%)	0 (0%)	-7.1 (-100%)
April	0 (NA)	7.1 (NA)	0 (NA)	7.1 (NA)	0 (NA)	7.1 (NA)
May	0 (NA)	7.1 (NA)	0 (NA)	7.1 (NA)	0 (NA)	7.1 (NA)
June	21.4 (33.3%)	28.6 (44.5%)	21.4 (33.3%)	28.6 (44.5%)	14.3 (20%)	0 (0%)
July	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
August	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
September	-28.6 (-36.4%)	-35.7 (-45.4%)	-42.9 (-46.2%)	-50 (-53.8%)	-50 (-50%)	-50 (-53.8%)

[a] Negative value indicates reduced percentage of years exceeding minimum flows under ESO.
[b] See Table 5C.0-1 for definitions of the scenarios.
NA: unable to calculate because dividing by 0

Table 5C.5.2-132. Percentage of Years Exceeding NMFS Suggested Minimum Flows in the Feather River High-Flow Channel at Thermalito Afterbay for ESO, HOS, and LOS Scenarios

Month	Scenario[a]					
	ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Above Normal						
October	72.7	72.7	81.8	81.8	81.8	81.8
November	72.7	72.7	72.7	72.7	72.7	72.7
December	27.3	27.3	27.3	9.1	27.3	36.4
January	27.3	18.2	27.3	27.3	36.4	36.4
February	72.7	63.6	63.6	72.7	72.7	63.6
March	45.5	45.5	36.4	45.5	36.4	45.5
April	0.0	0.0	27.3	36.4	0.0	0.0
May	18.2	18.2	45.5	27.3	9.1	18.2
June	81.8	90.9	72.7	72.7	81.8	90.9
July	100.0	100.0	90.9	90.9	100.0	100.0
August	100.0	100.0	72.7	72.7	100.0	100.0
September	100.0	100.0	81.8	27.3	81.8	18.2
Below Normal						
October	69.2	76.9	76.9	76.9	76.9	76.9
November	69.2	69.2	76.9	76.9	69.2	69.2
December	21.4	28.6	28.6	28.6	14.3	28.6
January	7.1	7.1	7.1	14.3	14.3	0.0
February	28.6	28.6	42.9	35.7	35.7	35.7
March	7.1	0.0	21.4	7.1	7.1	7.1
April	0.0	7.1	42.9	35.7	0.0	0.0
May	0.0	7.1	35.7	14.3	0.0	7.1
June	85.7	92.9	78.6	100.0	92.9	92.9
July	100.0	100.0	92.9	92.9	100.0	100.0
August	100.0	100.0	78.6	92.9	100.0	100.0
September	50.0	42.9	28.6	21.4	57.1	42.9

[a] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-133. Differences[a] between ESO Scenarios and HOS and LOS Scenarios in the Percentage of Years Exceeding NMFS Suggested Minimum Flows in the Feather River High-Flow Channel at Thermalito Afterbay

Month	Scenarios[b]			
	ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Above Normal				
October	9.1 (12.5%)	9.1 (12.5%)	9.1 (12.5%)	9.1 (12.5%)
November	0 (0%)	0 (0%)	0 (0%)	0 (0%)
December	0 (0%)	-18.2 (-66.7%)	0 (0%)	9.1 (33.3%)
January	0 (0%)	9.1 (50%)	9.1 (33.3%)	18.2 (100%)
February	-9.1 (-12.5%)	9.1 (14.3%)	0 (0%)	0 (0%)
March	-9.1 (-20%)	0 (0%)	-9.1 (-20%)	0 (0%)
April	27.3 (NA)	36.4 (NA)	0 (NA)	0 (NA)
May	27.3 (150%)	9.1 (50%)	-9.1 (-50%)	0 (0%)
June	-9.1 (-11.1%)	-18.2 (-20%)	0 (0%)	0 (0%)
July	-9.1 (-9.1%)	-9.1 (-9.1%)	0 (0%)	0 (0%)
August	-27.3 (-27.3%)	-27.3 (-27.3%)	0 (0%)	0 (0%)
September	-18.2 (-18.2%)	-72.7 (-72.7%)	-18.2 (-18.2%)	-81.8 (-81.8%)
Below Normal				
October	7.7 (11.1%)	0 (0%)	7.7 (11.1%)	0 (0%)
November	7.7 (11.1%)	7.7 (11.1%)	0 (0%)	0 (0%)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	7.2 (33.6%)	0 (0%)	-7.1 (-33.2%)	0 (0%)
February	0 (0%)	7.2 (101.4%)	7.2 (101.4%)	-7.1 (-100%)
March	14.3 (50%)	7.1 (24.8%)	7.1 (24.8%)	7.1 (24.8%)
April	14.3 (201.4%)	7.1 (NA)	0 (0%)	7.1 (NA)
May	42.9 (NA)	28.6 (402.8%)	0 (NA)	-7.1 (-100%)
June	35.7 (NA)	7.2 (101.4%)	0 (NA)	0 (0%)
July	-7.1 (-8.3%)	7.1 (7.6%)	7.2 (8.4%)	0 (0%)
August	-7.1 (-7.1%)	-7.1 (-7.1%)	0 (0%)	0 (0%)
September	-21.4 (-21.4%)	-7.1 (-7.1%)	0 (0%)	0 (0%)

[a] Positive values indicate an increased percentage of years exceeding the minimum flow under HOS or LOS.
[b] See Table 5C.0-1 for definitions of the scenarios.
NA: unable to calculate because dividing by 0

Predicted monthly mean flow data for each model scenario were used to evaluate the exceedance frequency of minimum flow criteria established by NMFS (2009, in prep.) for the Feather River low-flow and high-flow channels to maintain critical habitat features (Table 5C.5.2-9). In the low-flow channel, these criteria are 700 cfs flows from April through August and 800 cfs flows from September through March. In the high-flow channel, these criteria are 1,700 cfs from October through March and 1,000 cfs from April through September. Results of these evaluations are presented in Table 5C.5.2-134 through Table 5C.5.2-141. The exceedances of both flow thresholds under ESO_ELT and ESO_LLT would be similar to or greater than exceedances under EBC2_ELT and EBC2_LLT, respectively, in all water-year types with one exception (below normal years in the ELT for the 1,000 cfs threshold). These results indicate the ESO would have no effect in the low-flow channel and a slightly beneficial effect in the high-flow channel with respect to maintaining critical habitat features throughout the year, as well as for meeting NMFS BiOp flow criteria. Results of this analysis comparing HOS and LOS scenarios are presented in Table 5C.5.2-142 through Table 5C.5.2-149. These results indicate that the exceedance of thresholds under HOS and LOS scenarios would generally be similar to exceedances under ESO with few small exceptions in the high-flow channel. These exceptions consist of both higher and lower exceedance frequencies under HOS and LOS scenarios relative to ESO. Therefore, overall, the HOS and LOS scenarios would not affect the frequency of exceedance above these thresholds in the Feather River.

Table 5C.5.2-134. Percentage of Months that Exceed the April through August 700 cfs Flow Threshold in the Feather River Low-Flow Channel under EBC and ESO Scenarios

Water-Year Type[a]	Scenario[b]					
	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
W	100	100	100	100	100	100
AN	100	100	100	100	100	100
BN	100	100	100	100	100	100
D	100	100	100	100	100	100
C	100	100	100	100	100	100
All	100	100	100	100	100	100

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-135. Differences between EBC and ESO Scenarios in the Percentage of Months that Exceed the April through August 700 cfs Flow Threshold in the Feather River Low-Flow Channel

Water-Year Type[a]	Scenarios[b]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
W	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
D	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
C	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
All	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-136. Percentage of Months that Exceed the September through March 800 cfs Flow Threshold in the Feather River Low-Flow Channel under EBC and ESO Scenarios

Water-Year Type[a]	Scenario[b]					
	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
W	85.7	85.7	85.7	85.7	85.7	85.7
AN	85.7	85.7	85.7	85.7	85.7	85.7
BN	85.4	85.4	85.4	85.4	85.4	85.4
D	85.5	85.5	85.5	85.5	85.5	85.5
C	84.3	85.4	85.4	85.4	85.4	85.4
All	85.5	85.7	85.7	85.7	85.7	85.7

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-137. Differences[a] between EBC and ESO Scenarios in the Percentage of Months that Exceed the September through March 800 cfs Flow Threshold in the Feather River Low-Flow Channel

Water-Year Type[b]	Scenarios[c]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
W	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
D	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
C	1.1 (1.3%)[c]	1.1 (1.3%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
All	0.2 (0.2%)	0.2 (0.2%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

[a] Positive values indicate increased percentage of months exceeding the flow threshold in the ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-138. Percentage of Months that Exceed the October through March 1,700 cfs Flow Threshold in the Feather River High-Flow Channel under EBC and ESO Scenarios

Water-Year Type[a]	Scenario[b]					
	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
W	89.7	91.7	91.0	91.7	92.9	93.6
AN	75.8	80.3	75.8	77.3	77.3	78.8
BN	70.7	72.0	70.7	64.6	68.3	70.7
D	67.0	65.1	66.0	63.2	67.9	65.1
C	44.7	42.1	36.8	40.8	44.7	47.4
All	72.6	73.4	71.5	71.1	73.8	74.4

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-139. Differences[a] between EBC and ESO Scenarios in the Percentage of Months that Exceed the October through March 1,700 cfs Flow Threshold in the Feather River High-Flow Channel

Water-Year Type[b]	Scenarios[c]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
W	3.2 (3.6%)	3.8 (4.3%)	1.3 (1.4%)	1.3 (1.4%)	1.9 (2.1%)	1.9 (2.1%)
AN	1.5 (2%)	3 (4%)	-3 (-3.8%)	-3 (-3.8%)	1.5 (2%)	1.5 (2%)
BN	-2.4 (-3.4%)	0 (0%)	-3.7 (-5.1%)	-3.7 (-5.1%)	-2.4 (-3.4%)	6.1 (9.4%)
D	0.9 (1.4%)	-1.9 (-2.8%)	2.8 (4.3%)	2.8 (4.3%)	1.9 (2.9%)	1.9 (3%)
C	0 (0%)	2.6 (5.9%)	2.6 (6.3%)	2.6 (6.3%)	7.9 (21.4%)	6.6 (16.1%)
All	1.2 (1.7%)	1.8 (2.5%)	0.4 (0.6%)	0.4 (0.6%)	2.2 (3.1%)	3.3 (4.6%)

[a] Positive values indicate a greater percentage of months exceeding the flow threshold under the ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-140. Percentage of Months that Exceed the April through September 1,000 cfs Flow Threshold in the Feather River High-Flow Channel under EBC and ESO Scenarios

Water-Year Type[a]	Scenario[b]					
	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
W	94.9	98.1	96.8	97.4	97.4	97.4
AN	89.4	93.9	93.9	90.9	90.9	98.5
BN	92.9	90.5	95.2	91.7	89.3	94.0
D	90.7	87.0	86.1	85.2	86.1	88.9
C	82.1	83.3	85.9	83.3	83.3	80.8
All	90.9	91.5	92.1	90.7	90.4	92.5

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-141. Differences between EBC and ESO Scenarios in the Percentage of Months that Exceed the April through September 1,000 cfs Flow Threshold in the Feather River High-Flow Channel

Water-Year Type[b]	Scenarios[c]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
W	2.6 (2.7%)[c]	2.6 (2.7%)	-0.6 (-0.7%)	-0.6 (-0.7%)	0.6 (0.7%)	0 (0%)
AN	1.5 (1.7%)	9.1 (10.2%)	-3 (-3.2%)	-3 (-3.2%)	-3 (-3.2%)	7.6 (8.3%)
BN	-3.6 (-3.8%)	1.2 (1.3%)	-1.2 (-1.3%)	-1.2 (-1.3%)	-6 (-6.2%)	2.4 (2.6%)
D	-4.6 (-5.1%)	-1.9 (-2%)	-0.9 (-1.1%)	-0.9 (-1.1%)	0 (0%)	3.7 (4.3%)
C	1.3 (1.6%)	-1.3 (-1.6%)	0 (0%)	0 (0%)	-2.6 (-3%)	-2.6 (-3.1%)
All	-0.4 (-0.4%)	1.6 (1.8%)	-1 (-1.1%)	-1 (-1.1%)	-1.6 (-1.8%)	1.8 (2%)

[a] Positive values indicate a greater percentage of months exceeding the flow threshold under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-142. Percentage of Months that Exceed the April through August 700 cfs Flow Threshold in the Feather River Low-Flow Channel under ESO, HOS, and LOS Scenarios

	Scenario[b]					
Water-Year Type[a]	ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
W	100	100	100	100	100	100
AN	100	100	100	100	100	100
BN	100	100	100	100	100	100
D	100	100	100	100	100	100
C	100	100	100	100	100	100
All	100	100	100	100	100	100

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-143. Differences between ESO Scenarios and HOS and LOS Scenarios in the Percentage of Months that Exceed the April through August 700 cfs Flow Threshold in the Feather River Low-Flow Channel

	Scenarios[b]			
Water-Year Type[a]	ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
All	0 (0%)	0 (0%)	0 (0%)	0 (0%)

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-144. Percentage of Months that Exceed the September through March 800 cfs Flow Threshold in the Feather River Low-Flow Channel under ESO, HOS, and LOS Scenarios

	Scenario[b]					
Water-Year Type[a]	ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
W	85.7	85.7	85.7	85.7	85.7	85.7
AN	85.7	85.7	85.7	85.7	85.7	85.7
BN	85.4	85.4	85.4	85.4	85.4	85.4
D	85.5	85.5	85.5	85.5	85.5	85.5
C	85.4	85.4	85.4	85.4	85.4	85.4
All	85.7	85.7	85.7	85.7	85.7	85.7

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-145. Differences between the ESO Scenarios and HOS and LOS Scenarios in the Percentage of Months that Exceed the September through March 800 cfs Flow Threshold in the Feather River Low-Flow Channel

Water-Year Type[a]	Scenarios[b]			
	ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
All	0 (0%)	0 (0%)	0 (0%)	0 (0%)

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-146. Percentage of Months that Exceed the October through March 1,700 cfs Flow Threshold in the Feather River High-Flow Channel under ESO, HOS, and LOS Scenarios

Water-Year Type[a]	Scenario[b]					
	ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
W	92.9	93.6	89.1	90.4	92.9	94.2
AN	77.3	78.8	78.8	80.3	78.8	80.3
BN	68.3	70.7	67.1	62.2	68.3	68.3
D	67.9	65.1	64.2	65.1	67.9	65.1
C	44.7	47.4	47.4	53.9	51.3	48.7
All	73.8	74.4	71.7	73.2	75.0	74.6

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-147. Differences[a] between the ESO Scenario and HOS and LOS Scenarios in the Percentage of Months that Exceed the October through March 1,700 cfs Flow Threshold in the Feather River High-Flow Channel

Water-Year Type[b]	Scenarios[c]			
	ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
W	-3.8 (-4.1%)	-3.2 (-3.4%)	0 (0%)	0.6 (0.7%)[c]
AN	1.5 (2%)	1.5 (1.9%)	1.5 (2%)	1.5 (1.9%)
BN	-1.2 (-1.8%)	-8.5 (-12.1%)	0 (0%)	-2.4 (-3.4%)
D	-3.8 (-5.6%)	0 (0%)	0 (0%)	0 (0%)
C	2.6 (5.9%)	6.6 (13.9%)	6.6 (14.7%)	1.3 (2.8%)
All	-2 (-2.8%)	-1.2 (-1.6%)	1.2 (1.7%)	0.2 (0.3%)

[a] Positive values indicate an increased percentage of months that exceed the flow threshold under HOS or LOS.
[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-148. Percentage of Months that Exceed the April through September 1,000 cfs Flow Threshold in the Feather River High-Flow Channel under ESO, HOS, and LOS Scenarios

	Scenario[b]					
Water-Year Type[a]	ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
W	97.4	97.4	94.2	96.2	92.3	96.2
AN	90.9	98.5	89.4	95.5	93.9	98.5
BN	89.3	94	92.9	91.7	90.5	95.2
D	86.1	88.9	84.3	89.8	89.8	90.7
C	83.3	80.8	92.3	92.3	80.8	82.1
All	90.4	92.5	90.9	93.3	89.8	92.9

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-149. Differences[a] between the ESO Scenario and HOS and LOS Scenarios in the Percentage of Months that Exceed the April through September 1,000 cfs Flow Threshold in the Feather River High-Flow Channel

	Scenarios[c]			
Water-Year Type[b]	ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
W	-3.2 (-3.3%)	-1.2 (-1.3%)	-5.1 (-5.2%)	-1.2 (-1.3%)
AN	-1.5 (-1.7%)	-3 (-3.1%)	3 (3.3%)[c]	0 (0%)
BN	3.6 (4%)	-2.3 (-2.5%)	1.2 (1.3%)	1.2 (1.3%)
D	-1.8 (-2.1%)	0.9 (1%)	3.7 (4.3%)	1.8 (2.1%)
C	9 (10.8%)	11.5 (14.2%)	-2.5 (-3%)	1.3 (1.5%)
All	0.5 (0.5%)	0.8 (0.9%)	-0.6 (-0.6%)	0.4 (0.4%)

[a] Positive values indicate a greater percentage of months exceeding flow threshold under HOS or LOS.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Water Temperature

Results of water temperature simulation analyses for the Feather River low-flow channel (above Thermalito Afterbay) and high-flow channel (below Thermalito Afterbay) during January through April were used to determine the potential temperature-related effects of the ESO on steelhead egg incubation. Monthly mean temperatures by water-year type in the low-flow and high-flow channels are presented in Table 5C.5.2-150 and Table 5C.5.2-151, respectively, and differences between pairs of model scenarios are presented in Table 5C.5.2-152 and Table 5C.5.2-153, respectively. Mean monthly water temperatures under ESO_ELT and ESO_LLT at both locations would be similar to temperatures under EBC2_ELT and EBC2_LLT, respectively, throughout the period regardless of water-year type. Mean monthly water temperatures throughout the year under HOS and LOS scenarios would not differ by more than 4% from those under ESO regardless of month or water-year type (Table 5C.5.2-154 through Table 5C.5.2-157).

Table 5C.5.2-150. Mean Monthly Water Temperature (°F) in the Feather River Low-Flow Channel (above Thermalito Afterbay) under EBC and ESO Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	47	47	49	50	49	50
	AN	47	47	49	50	49	50
	BN	47	47	49	50	48	50
	D	47	47	49	50	48	50
	C	47	47	49	51	49	51
	All	47	47	49	50	49	50
Feb	W	49	49	50	51	50	51
	AN	49	49	50	51	50	51
	BN	49	49	50	52	50	52
	D	49	49	51	52	51	52
	C	50	50	51	53	51	53
	All	49	49	50	52	50	52
Mar	W	50	50	51	53	51	53
	AN	51	51	52	53	52	53
	BN	51	52	53	54	53	55
	D	52	52	54	55	54	55
	C	53	53	54	56	54	56
	All	51	51	53	54	53	54
Apr	W	53	53	54	55	54	55
	AN	55	55	55	57	55	57
	BN	55	55	56	57	56	57
	D	55	55	56	57	56	57
	C	55	55	56	57	56	57
	All	55	55	55	57	55	57
May	W	59	59	60	61	60	61
	AN	60	60	61	62	61	62
	BN	60	60	61	61	61	61
	D	60	60	61	61	61	61
	C	60	60	61	62	61	62
	All	60	60	61	61	61	61
Jun	W	63	63	64	65	64	64
	AN	64	64	65	66	65	65
	BN	64	64	65	65	64	65
	D	64	64	65	66	65	66
	C	63	63	64	65	64	65
	All	64	64	65	65	64	65
Jul	W	68	68	68	69	68	69
	AN	67	67	68	69	68	69
	BN	67	67	68	69	68	69
	D	67	67	68	69	68	69
	C	67	68	69	70	69	71
	All	67	67	68	69	68	69

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Aug	W	66	66	67	68	67	68
	AN	65	65	66	67	66	67
	BN	66	66	67	68	67	68
	D	65	65	67	68	67	68
	C	67	67	68	70	68	69
	All	66	66	67	68	67	68
Sep	W	60	59	60	61	60	61
	AN	60	59	60	61	60	61
	BN	60	60	61	62	61	63
	D	60	60	61	65	62	64
	C	61	61	62	66	62	66
	All	60	60	61	63	61	63
Oct	W	55	55	56	60	56	59
	AN	57	56	57	60	57	60
	BN	56	56	57	60	57	60
	D	56	56	57	61	57	61
	C	56	56	57	60	57	60
	All	56	56	57	60	57	60
Nov	W	52	52	53	58	53	58
	AN	53	53	55	58	55	57
	BN	53	53	54	58	54	58
	D	53	53	54	58	55	58
	C	53	53	54	58	54	58
	All	53	53	54	58	54	58
Dec	W	48	48	50	53	50	52
	AN	49	49	50	54	50	53
	BN	48	48	50	53	50	53
	D	48	48	50	53	50	53
	C	48	48	50	53	50	53
	All	48	48	50	53	50	53

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-151. Mean Monthly Water Temperature (°F) in the Feather River High-Flow Channel (below Thermalito Afterbay) under EBC and ESO Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	47	47	48	50	48	50
	AN	47	47	48	50	48	49
	BN	46	46	48	49	47	49
	D	46	46	47	49	47	49
	C	46	46	48	50	48	50
	All	47	46	48	49	48	49
Feb	W	49	49	50	52	50	51
	AN	49	49	51	52	51	52
	BN	49	50	51	52	51	52
	D	50	50	51	53	51	53
	C	51	51	52	54	52	54
	All	50	50	51	52	51	52
Mar	W	51	51	52	54	52	54
	AN	52	53	53	54	53	54
	BN	53	54	55	56	55	56
	D	54	54	55	57	56	57
	C	54	54	55	57	55	57
	All	53	53	54	55	54	55
Apr	W	55	55	56	57	56	57
	AN	57	57	58	59	58	59
	BN	58	57	58	59	58	59
	D	57	57	58	60	59	60
	C	57	57	58	60	58	60
	All	57	57	57	59	57	59
May	W	61	61	62	63	62	63
	AN	63	63	64	64	63	64
	BN	63	63	64	65	64	64
	D	63	63	64	65	64	65
	C	63	63	65	66	65	65
	All	62	62	63	64	63	64
Jun	W	66	66	67	68	66	67
	AN	67	67	69	70	67	68
	BN	67	67	69	70	66	67
	D	68	68	69	71	69	70
	C	68	68	69	71	69	70
	All	67	67	68	70	67	68
Jul	W	70	69	70	70	70	71
	AN	68	68	68	69	68	69
	BN	68	68	69	70	69	71
	D	68	68	69	70	70	73
	C	70	70	72	74	74	76
	All	69	69	70	71	70	72

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Aug	W	70	70	70	70	70	72
	AN	67	67	68	69	69	70
	BN	68	68	69	70	70	72
	D	67	68	69	71	71	72
	C	70	71	72	74	71	74
	All	69	69	70	71	70	72
Sep	W	64	61	62	63	63	64
	AN	64	61	62	64	64	65
	BN	65	65	66	68	65	67
	D	64	64	65	67	64	66
	C	64	64	66	69	66	69
	All	64	63	64	66	64	66
Oct	W	58	59	60	62	60	62
	AN	60	59	61	63	61	63
	BN	59	59	61	63	60	63
	D	58	58	60	63	59	63
	C	59	59	60	63	60	63
	All	59	59	60	63	60	63
Nov	W	53	53	54	57	54	57
	AN	54	54	55	58	55	58
	BN	53	53	54	57	54	57
	D	53	53	54	57	54	57
	C	53	53	55	57	55	58
	All	53	53	54	57	54	57
Dec	W	48	47	49	51	49	51
	AN	48	48	49	52	49	52
	BN	47	47	48	51	49	51
	D	47	47	49	51	49	51
	C	47	47	48	50	48	51
	All	47	47	49	51	49	51

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-152. Differences[a] between EBC and ESO Scenarios in Mean Monthly Water Temperature (°F) in the Feather River Low-Flow Channel (above Thermalito Afterbay)

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	1 (2.8%)	3 (6.0%)	1 (2.8%)	3 (6%)	0 (0%)	0.04 (0.1%)
	AN	1 (3.1%)	3 (6.6%)	1 (2.8%)	3 (6.2%)	-0.1 (-0.2%)	0 (0%)
	BN	1 (2.6%)	3 (6.3%)	1 (3.0%)	3 (6.7%)	-0.1 (-0.3%)	0 (0%)
	D	2 (3.3%)	3 (7.2%)	1 (3.2%)	3 (7.1%)	-0.1 (-0.3%)	0.1 (0.2%)
	C	2 (3.7%)	4 (7.8%)	2 (3.8%)	4 (8%)	0.1 (0.2%)	0 (0.1%)
	All	1 (3.0%)	3 (6.7%)	1 (3.1%)	3 (6.7%)	-0.1 (-0.1%)	0.05 (0.1%)
Feb	W	1 (2.5%)	3 (5.4%)	1 (2.6%)	3 (5.6%)	0.03 (0.1%)	-0.05 (-0.1%)
	AN	1 (2.7%)	3 (5.4%)	1 (2.7%)	3 (5.3%)	0 (0%)	0.04 (0.1%)
	BN	1 (2.9%)	3 (6.3%)	1 (2.7%)	3 (6.1%)	-0.1 (-0.1%)	0.1 (0.2%)
	D	1 (3.0%)	3 (6.0%)	1 (2.9%)	3 (5.9%)	0 (0%)	0.1 (0.1%)
	C	2 (3.3%)	3 (6.7%)	2 (3.2%)	3 (6.7%)	-0.03 (-0.1%)	0 (0%)
	All	1 (2.8%)	3 (5.9%)	1 (2.8%)	3 (5.9%)	0 (0%)	0.03 (0.1%)
Mar	W	1 (2.1%)	3 (5.0%)	1 (2.2%)	3 (5.2%)	0.1 (0.1%)	0.1 (0.1%)
	AN	1 (1.8%)	2 (4.5%)	1 (1.8%)	2 (4.6%)	0 (0%)	0 (0%)
	BN	2 (3%)	3 (6.4%)	1.2 (2.3%)	3 (5.7%)	0.1 (0.1%)	0.3 (0.5%)
	D	1.2 (2.2%)	3 (4.8%)	1 (2.0%)	2 (4.6%)	-0.1 (-0.2%)	0.1 (0.2%)
	C	1 (2.6%)	3 (5.6%)	1 (2.4%)	3 (5.4%)	0.2 (0.3%)	-0.05 (-0.1%)
	All	1 (2.3%)	3 (5.2%)	1 (2.2%)	3 (5.1%)	0.03 (0.1%)	0.1 (0.2%)
Apr	W	1 (1.2%)	2 (3.6%)	1 (1.2%)	2 (3.6%)	0.03 (0.1%)	0 (0%)
	AN	1 (1.3%)	2 (3.6%)	1 (1.3%)	2 (3.7%)	0.04 (0.1%)	0.1 (0.1%)
	BN	1 (1.1%)	2 (3.5%)	1 (1.0%)	2 (3.4%)	0 (0%)	0.1 (0.1%)
	D	1 (1.4%)	2 (3.6%)	1 (1.4%)	2 (3.7%)	-0.1 (-0.1%)	-0.2 (-0.3%)
	C	1 (1.8%)	3 (4.6%)	1 (1.9%)	3 (4.6%)	-0.1 (-0.1%)	-0.04 (-0.1%)
	All	1 (1.3%)	2 (3.7%)	1 (1.3%)	2 (3.7%)	0 (0%)	0 (0%)
May	W	1 (1.3%)	1 (2.3%)	1 (1.3%)	1 (2.3%)	0 (0%)	-0.1 (-0.1%)
	AN	1 (1.1%)	1 (1.9%)	1 (1.1%)	1 (1.9%)	-0.2 (-0.3%)	-0.2 (-0.3%)
	BN	1 (1.2%)	1 (1.6%)	1 (1.2%)	1 (1.6%)	-0.04 (-0.1%)	-0.2 (-0.3%)
	D	1 (1.2%)	1 (1.9%)	1 (1.2%)	1 (1.9%)	0 (0%)	0 (0%)
	C	1 (1.5%)	1 (2.4%)	1 (1.4%)	1 (2.4%)	0.1 (0.1%)	-0.1 (-0.2%)
	All	1 (1.3%)	1 (2%)	1 (1.2%)	1 (2%)	0 (0%)	-0.1 (-0.2%)
Jun	W	1 (1.2%)	1 (2.2%)	1 (1.2%)	1 (2.2%)	-0.3 (-0.4%)	-0.2 (-0.3%)
	AN	1 (1%)	1 (2.2%)	1 (1%)	1 (2.2%)	-0.3 (-0.5%)	-0.3 (-0.5%)
	BN	0 (0.7%)	1 (2.0%)	0 (0.7%)	1 (2.0%)	-0.4 (-0.7%)	-0.3 (-0.5%)
	D	0.8 (1.2%)	2 (2.8%)	0.8 (1.3%)	2 (2.9%)	-0.1 (-0.2%)	-0.04 (-0.1%)
	C	1 (1.5%)	2 (3.3%)	1 (1.5%)	2 (3.3%)	0.1 (0.2%)	-0.1 (-0.1%)
	All	1 (1.1%)	2 (2.5%)	1 (1.2%)	2 (2.5%)	-0.2 (-0.3%)	-0.2 (-0.3%)
Jul	W	1 (1.2%)	2 (2.5%)	1 (1.3%)	2 (2.5%)	0 (0%)	0.1 (0.1%)
	AN	0.9 (1.3%)	2 (2.7%)	0.9 (1.3%)	2 (2.7%)	0 (0%)	0.04 (0.1%)
	BN	1 (1.4%)	2 (2.8%)	1 (1.4%)	2 (2.8%)	0.04 (0.1%)	0.1 (0.2%)
	D	1 (1.7%)	2 (3.4%)	1 (1.7%)	2 (3.4%)	0.2 (0.3%)	0.3 (0.5%)
	C	2 (2.8%)	3 (4.8%)	1 (2.2%)	3 (4.2%)	0.4 (0.6%)	0.6 (0.9%)
	All	1 (1.6%)	2 (3.1%)	1 (1.6%)	2 (3.1%)	0.1 (0.2%)	0.2 (0.3%)

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Aug	W	0.7 (1.1%)	2 (2.6%)	1 (1.3%)	2 (2.8%)	0.2 (0.3%)	0.2 (0.4%)
	AN	0.9 (1.3%)	2 (30%)	1 (1.5%)	2 (3.1%)	0.1 (0.2%)	0.2 (0.4%)
	BN	1 (1.6%)	2 (3.5%)	1 (1.6%)	2 (3.5%)	0.1 (0.1%)	0.3 (0.4%)
	D	1 (2.2%)	3 (4.0%)	1 (1.8%)	2 (3.6%)	0.1 (0.2%)	-0.2 (-0.3%)
	C	1 (1.5%)	3 (3.9%)	1 (1.4%)	3 (3.9%)	-1 (-0.9%)	-0.6 (-0.8%)
	All	1 (1.5%)	2 (3.3%)	1 (1.5%)	2 (3.3%)	0 (0%)	0 (0%)
Sep	W	0 (-0.5%)	1 (1.8%)	1 (1.3%)	2 (3.7%)	0.1 (0.2%)	0.3 (0.5%)
	AN	0 (-0.2%)	1 (1.8%)	1 (1.5%)	2 (3.5%)	0.3 (0.4%)	0.3 (0.4%)
	BN	1 (1.7%)	3 (4.6%)	1 (2.0%)	3 (4.9%)	1 (1.0%)	0.5 (0.8%)
	D	2 (2.9%)	4 (6.2%)	2 (2.6%)	4 (6%)	0.1 (0.2%)	-1 (-1.7%)
	C	1 (1.3%)	5 (7.4%)	1 (2.2%)	5 (8.3%)	-0.2 (-0.3%)	-1 (-0.8%)
	All	1 (0.9%)	2 (4.1%)	1 (1.9%)	3 (5.1%)	0.2 (0.3%)	-0.1 (-0.2%)
Oct	W	1 (1.4%)	4 (6.8%)	1 (1.3%)	4 (6.7%)	-0.1 (-0.1%)	-1 (-0.9%)
	AN	1 (1.4%)	3 (5.4%)	1.2 (2.2%)	3 (6.1%)	0.1 (0.1%)	-0.3 (-0.6%)
	BN	1 (1.8%)	4 (7%)	1 (1.3%)	4 (6.4%)	-0.2 (-0.3%)	-0.3 (-0.4%)
	D	1 (1.8%)	5 (9.7%)	1 (1.8%)	5 (9.8%)	-1 (-1.1%)	0.2 (0.3%)
	C	1 (1.6%)	4 (6.9%)	1 (1.6%)	4 (6.9%)	-0.3 (-0.6%)	0.1 (0.2%)
	All	1 (1.6%)	4 (7.3%)	1 (1.6%)	4 (7.3%)	-0.2 (-0.4%)	-0.2 (-0.4%)
Nov	W	1 (2.1%)	5 (10.1%)	1 (2.1%)	5 (10%)	0 (0%)	-0.1 (-0.2%)
	AN	1 (2.4%)	4 (7.7%)	1 (2.2%)	4 (7.5%)	0.04 (0.1%)	-1 (-0.9%)
	BN	1 (1.8%)	5 (9.3%)	1 (2.1%)	5 (9.6%)	-0.03 (-0.1%)	-0.1 (-0.2%)
	D	2 (3.9%)	6 (10.6%)	2 (3.9%)	6 (10.5%)	0.3 (0.5%)	-0.2 (-0.4%)
	C	1 (1.9%)	5 (9.7%)	1 (1.9%)	5 (9.6%)	-0.1 (-0.2%)	0.3 (0.5%)
	All	1 (2.5%)	5 (9.7%)	1 (2.5%)	5 (9.7%)	0.1 (0.1%)	-0.1 (-0.2%)
Dec	W	2 (3.5%)	4 (8.6%)	2 (3.7%)	4 (8.7%)	-0.1 (-0.2%)	-0.1 (-0.2%)
	AN	2 (3.5%)	5 (10%)	2 (3.3%)	5 (9.9%)	-0.1 (-0.3%)	-0.3 (-0.5%)
	BN	2 (4.7%)	5 (10.3%)	2 (4.5%)	5 (10.1%)	0.4 (0.7%)	-0.1 (-0.2%)
	D	2.2 (4.7%)	5 (9.8%)	2 (4.5%)	5 (9.6%)	0 (0%)	0 (0%)
	C	2 (4.2%)	5 (9.5%)	2 (4.2%)	5 (9.5%)	0.5 (1%)	0.1 (0.3%)
	All	2 (4.1%)	5 (9.5%)	2 (4.0%)	5 (9.4%)	0.1 (0.2%)	-0.1 (-0.1%)

[a] Positive values indicate higher water temperatures under ESO than under EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-153. Differences[a] between EBC and ESO Scenarios in Mean Monthly Water Temperature (°F) in the Feather River High-Flow Channel (below Thermalito Afterbay)

Month	Water-Year Type[b]	Scenario[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	1 (2.6%)	3 (5.7%)	1 (2.7%)	3 (5.8%)	-0.05 (-0.1%)	0 (0%)
	AN	1 (2.8%)	3 (6.2%)	1 (2.8%)	3 (6.3%)	-0.1 (-0.2%)	-0.03 (-0.1%)
	BN	1 (2.4%)	3 (6%)	1 (2.8%)	3 (6.4%)	-0.2 (-0.4%)	0.1 (0.1%)
	D	1 (3%)	3 (6.6%)	1 (3.1%)	3 (6.7%)	0.1 (0.2%)	0.1 (0.3%)
	C	1 (3.1%)	3 (7.2%)	2 (3.4%)	3 (7.6%)	-0.1 (-0.2%)	0.1 (0.2%)
	All	1 (2.8%)	3 (6.3%)	1 (2.9%)	3 (6.4%)	-0.1 (-0.1%)	0.1 (0.1%)
Feb	W	1 (2.5%)	2 (5.1%)	1 (2.4%)	2 (5%)	0 (0%)	-0.2 (-0.3%)
	AN	1 (2.8%)	3 (5.9%)	1 (2.3%)	3 (5.4%)	-0.2 (-0.4%)	-0.2 (-0.3%)
	BN	2 (3.3%)	3 (6.1%)	1 (3%)	3 (5.8%)	0.1 (0.1%)	0.1 (0.1%)
	D	1 (2.9%)	3 (5.6%)	1 (2.8%)	3 (5.5%)	0.03 (0.1%)	0.04 (0.1%)
	C	2 (3%)	3 (6.1%)	2 (3%)	3 (6.1%)	0 (0%)	0 (0%)
	All	1 (2.8%)	3 (5.7%)	1 (2.7%)	3 (5.5%)	0 (0%)	-0.1 (-0.1%)
Mar	W	1 (1.9%)	2 (4.8%)	1 (1.8%)	2 (4.7%)	0.1 (0.1%)	0.1 (0.3%)
	AN	0 (0.7%)	2 (3.1%)	0 (0.5%)	2 (2.9%)	0.04 (0.1%)	-0.1 (-0.1%)
	BN	2 (2.9%)	3 (6.1%)	1.1 (2.1%)	3 (5.3%)	0.2 (0.4%)	0.2 (0.4%)
	D	1.3 (2.4%)	3 (4.7%)	1 (2%)	2 (4.3%)	0.1 (0.2%)	0.1 (0.1%)
	C	2 (3%)	3 (5.8%)	2 (2.9%)	3 (5.7%)	0.2 (0.4%)	0.1 (0.2%)
	All	1 (2.2%)	3 (4.9%)	1 (1.9%)	2 (4.6%)	0.1 (0.2%)	0.1 (0.2%)
Apr	W	1 (1.3%)	2 (3.7%)	1 (1.3%)	2 (3.7%)	0 (0%)	0 (0%)
	AN	1 (1.5%)	2 (4.1%)	1 (1.5%)	2 (4.1%)	0 (0%)	0.1 (0.1%)
	BN	0 (0.8%)	2 (2.7%)	1 (1%)	2 (2.9%)	0 (0%)	-0.2 (-0.3%)
	D	1 (2.3%)	3 (4.5%)	1 (2.3%)	3 (4.5%)	0.3 (0.4%)	0.2 (0.3%)
	C	1 (2.2%)	3 (4.9%)	1 (2.4%)	3 (5%)	0.1 (0.3%)	0.3 (0.5%)
	All	1 (1.6%)	2 (3.9%)	1 (1.7%)	2 (4%)	0.1 (0.1%)	0.1 (0.1%)
May	W	1 (2.2%)	3 (4.2%)	1 (2.2%)	3 (4.2%)	0 (0%)	-0.2 (-0.3%)
	AN	0 (0.8%)	1 (2.3%)	0 (0.8%)	1 (2.3%)	-0.4 (-0.6%)	-0.2 (-0.2%)
	BN	1 (1.7%)	2 (2.9%)	1 (1.8%)	2 (3%)	-0.1 (-0.1%)	-0.3 (-0.5%)
	D	1 (2.3%)	2 (3.4%)	1 (2.3%)	2 (3.4%)	-0.1 (-0.1%)	-0.2 (-0.3%)
	C	1 (2.3%)	2 (3.4%)	1 (2.4%)	2 (3.5%)	-0.1 (-0.1%)	-0.1 (-0.2%)
	All	1 (2%)	2 (3.4%)	1 (2%)	2 (3.4%)	-0.1 (-0.1%)	-0.2 (-0.3%)
Jun	W	1 (0.8%)	1 (1.6%)	1 (0.8%)	1 (1.6%)	-1 (-1.7%)	-2 (-2.4%)
	AN	0 (-0.6%)	0 (0.2%)	0 (-0.6%)	0 (0.3%)	-2 (-2.7%)	-2 (-3.4%)
	BN	-1 (-1.7%)	0 (0.1%)	-1 (-1.8%)	0 (0%)	-2 (-3.5%)	-2 (-3.3%)
	D	0.5 (0.8%)	2 (3.5%)	0.4 (0.7%)	2 (3.3%)	-1 (-1.3%)	-1 (-0.7%)
	C	2 (2.5%)	3 (4.2%)	2 (2.4%)	3 (4.1%)	0.1 (0.1%)	-0.2 (-0.2%)
	All	0 (0.4%)	1 (2%)	0 (0.4%)	1 (1.9%)	-1 (-1.8%)	-1 (-2%)
Jul	W	0 (0.4%)	1 (1.5%)	0 (0.7%)	1 (1.8%)	0.3 (0.4%)	1 (0.9%)
	AN	0.4 (0.6%)	1 (2.2%)	0.7 (1%)	2 (2.6%)	-0.1 (-0.1%)	0.1 (0.1%)
	BN	1 (1.9%)	3 (4.2%)	1 (2%)	3 (4.2%)	0.3 (0.4%)	1 (1.2%)
	D	2 (3.6%)	5 (6.8%)	2 (3.5%)	5 (6.7%)	1 (1.6%)	2 (3.3%)
	C	5 (6.5%)	7 (9.6%)	4 (5.7%)	6 (8.8%)	3 (3.5%)	2 (3.3%)
	All	2 (2.3%)	3 (4.4%)	2 (2.3%)	3 (4.4%)	1 (1.1%)	1 (1.7%)

Month	Water-Year Type[b]	Scenario[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Aug	W	0.3 (0.4%)	2 (2.5%)	1 (0.8%)	2 (2.9%)	0.3 (0.4%)	1 (1.6%)
	AN	1.3 (1.9%)	3 (4.7%)	1.3 (1.9%)	3 (4.7%)	1 (0.9%)	1 (2%)
	BN	2 (2.6%)	3 (5.1%)	2 (2.8%)	4 (5.2%)	1 (0.8%)	1 (1.8%)
	D	4 (5.3%)	5 (7.6%)	3 (4.7%)	5 (6.9%)	2 (2.2%)	1 (1.7%)
	C	2 (2.2%)	4 (5.8%)	1 (1.1%)	3 (4.7%)	-1 (-0.9%)	-0.1 (-0.1%)
	All	2 (2.3%)	3 (4.8%)	1 (2.2%)	3 (4.7%)	0.5 (0.7%)	1 (1.4%)
Sep	W	-1 (-1.6%)	0 (0.5%)	2 (3.2%)	3 (5.4%)	1 (1.9%)	1 (1.7%)
	AN	0 (-0.6%)	1 (2.1%)	2 (3.8%)	4 (6.5%)	1 (2.4%)	2 (2.8%)
	BN	0 (-0.1%)	2 (3%)	0 (-0.4%)	2 (2.7%)	-1 (-1.6%)	-1 (-1.4%)
	D	0 (0.4%)	2 (3.7%)	1 (0.8%)	3 (4.2%)	-0.2 (-0.4%)	-0.1 (-0.2%)
	C	2 (3%)	5 (7.4%)	2 (3.3%)	5 (7.7%)	0.3 (0.5%)	-0.2 (-0.2%)
	All	0 (-0.1%)	2 (2.9%)	1 (2.1%)	3 (5.2%)	0.4 (0.6%)	0.4 (0.6%)
Oct	W	1 (2%)	4 (6.4%)	1 (1.8%)	4 (6.1%)	-0.1 (-0.2%)	-0.2 (-0.4%)
	AN	1 (1.7%)	3 (5.3%)	1.1 (1.9%)	3 (5.5%)	-0.05 (-0.1%)	-0.3 (-0.4%)
	BN	1 (1.7%)	4 (5.9%)	1 (1.4%)	3 (5.6%)	-0.2 (-0.4%)	-0.1 (-0.2%)
	D	1 (2%)	4 (7.6%)	1.2 (2%)	4 (7.6%)	-0.2 (-0.3%)	0.2 (0.3%)
	C	1 (2.5%)	4 (6.8%)	1 (2.4%)	4 (6.7%)	0.1 (0.2%)	0.2 (0.3%)
	All	1 (2%)	4 (6.5%)	1 (1.9%)	4 (6.4%)	-0.1 (-0.2%)	-0.1 (-0.1%)
Nov	W	1 (2.2%)	4 (8%)	1 (2.1%)	4 (7.9%)	0.03 (0.1%)	-0.1 (-0.1%)
	AN	1 (2.6%)	4 (7.1%)	1 (2.4%)	4 (6.9%)	0 (0%)	-0.2 (-0.4%)
	BN	1 (2.1%)	4 (7.6%)	1 (2.4%)	4 (7.8%)	0 (0%)	-0.1 (-0.2%)
	D	2 (3.2%)	5 (8.5%)	2 (3.2%)	5 (8.5%)	0.1 (0.1%)	-0.2 (-0.3%)
	C	1 (2.2%)	4 (7.9%)	1 (2.2%)	4 (7.9%)	0.02 (0%)	0.2 (0.3%)
	All	1 (2.5%)	4 (7.9%)	1 (2.5%)	4 (7.9%)	0.03 (0.1%)	-0.1 (-0.1%)
Dec	W	1 (2.9%)	3 (7.2%)	2 (3.3%)	4 (7.6%)	-0.1 (-0.2%)	-0.04 (-0.1%)
	AN	2 (3.3%)	4 (8.9%)	1 (3%)	4 (8.6%)	-0.1 (-0.2%)	-0.3 (-0.5%)
	BN	2 (3.8%)	4 (8.7%)	2 (3.7%)	4 (8.7%)	0.2 (0.5%)	-0.1 (-0.2%)
	D	1.9 (4.1%)	4 (8.2%)	2 (4%)	4 (8.1%)	0.1 (0.3%)	-0.2 (-0.5%)
	C	1 (2.7%)	4 (8.6%)	1 (2.7%)	4 (8.7%)	-0.1 (-0.3%)	0.2 (0.3%)
	All	2 (3.4%)	4 (8.1%)	2 (3.4%)	4 (8.2%)	0 (0%)	-0.1 (-0.2%)

[a] Positive values indicate higher temperatures under ESO than under EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-154. Mean Monthly Water Temperature (°F) in the Feather River Low-Flow Channel (above Thermalito Afterbay) under ESO, HOS, and LOS Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	49	50	49	50	49	50
	AN	49	50	48	50	49	50
	BN	48	50	48	50	48	50
	D	48	50	48	50	48	50
	C	49	51	49	51	49	51
	All	49	50	49	50	49	50
Feb	W	50	51	50	52	50	51
	AN	50	51	50	52	50	51
	BN	50	52	50	52	50	52
	D	51	52	51	52	51	52
	C	51	53	52	53	51	53
	All	50	52	50	52	50	52
Mar	W	51	53	52	53	51	53
	AN	52	53	52	53	52	53
	BN	53	55	53	54	53	54
	D	54	55	53	55	53	55
	C	54	56	54	55	54	56
	All	53	54	53	54	53	54
Apr	W	54	55	54	56	54	55
	AN	55	57	55	57	55	56
	BN	56	57	56	57	55	57
	D	56	57	56	57	56	57
	C	56	57	56	57	56	58
	All	55	57	55	57	55	56
May	W	60	61	60	61	60	61
	AN	61	62	61	62	61	61
	BN	61	61	61	61	60	61
	D	61	61	61	61	61	61
	C	61	62	61	62	61	62
	All	61	61	61	61	60	61
Jun	W	64	64	64	64	64	65
	AN	65	65	65	65	65	66
	BN	64	65	64	65	65	65
	D	65	66	65	66	65	66
	C	64	65	64	65	64	65
	All	64	65	64	65	65	65
Jul	W	68	69	68	69	69	69
	AN	68	69	68	69	68	69
	BN	68	69	68	69	68	69
	D	68	69	68	69	68	69
	C	69	71	69	70	69	70
	All	68	69	68	69	68	69

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Aug	W	67	68	67	68	67	69
	AN	66	67	66	67	67	68
	BN	67	68	67	68	67	69
	D	67	68	67	68	67	68
	C	68	69	68	69	67	68
	All	67	68	67	68	67	68
Sep	W	60	61	61	62	60	62
	AN	60	61	61	62	61	63
	BN	61	63	61	63	63	65
	D	62	64	61	63	61	63
	C	62	66	62	65	61	64
	All	61	63	61	63	61	63
Oct	W	56	59	56	58	57	60
	AN	57	60	57	59	58	62
	BN	57	60	57	59	58	61
	D	57	61	56	59	58	61
	C	57	60	57	59	57	58
	All	57	60	57	59	58	60
Nov	W	53	58	53	56	54	57
	AN	55	57	55	57	55	58
	BN	54	58	53	56	55	57
	D	55	58	54	57	55	58
	C	54	58	54	58	53	56
	All	54	58	54	57	54	57
Dec	W	50	52	50	52	50	53
	AN	50	53	50	53	51	53
	BN	50	53	50	53	50	53
	D	50	53	50	52	50	53
	C	50	53	50	53	49	52
	All	50	53	50	53	50	53

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

1 **Table 5C.5.2-155. Mean Monthly Water Temperature (°F) in the Feather River High-Flow Channel**
2 **(below Thermalito Afterbay) for ESO, HOS, and LOS Scenarios**

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	48	50	48	50	48	50
	AN	48	49	48	49	48	50
	BN	47	49	48	49	47	49
	D	47	49	47	49	47	49
	C	48	50	48	50	48	50
	All	48	49	48	49	48	50
Feb	W	50	51	50	52	50	52
	AN	51	52	51	52	51	52
	BN	51	52	51	52	51	52
	D	51	53	51	53	51	53
	C	52	54	52	54	52	54
	All	51	52	51	52	51	52
Mar	W	52	54	52	54	52	54
	AN	53	54	53	54	53	54
	BN	55	56	55	56	55	56
	D	56	57	56	57	56	57
	C	55	57	55	57	55	57
	All	54	55	54	55	54	55
Apr	W	56	57	55	56	56	57
	AN	58	59	57	58	58	60
	BN	58	59	56	58	58	59
	D	59	60	58	60	59	60
	C	58	60	58	60	58	60
	All	57	59	57	58	57	59
May	W	62	63	61	62	62	63
	AN	63	64	62	63	63	64
	BN	64	64	63	64	64	65
	D	64	65	64	65	64	65
	C	65	65	65	66	65	65
	All	63	64	63	64	63	64
Jun	W	66	67	67	68	66	67
	AN	67	68	69	70	67	68
	BN	66	67	68	68	66	67
	D	69	70	69	71	68	70
	C	69	70	69	71	69	71
	All	67	68	68	69	67	68
Jul	W	70	71	71	72	70	71
	AN	68	69	71	72	68	70
	BN	69	71	70	72	70	71
	D	70	73	71	73	70	72
	C	74	76	74	75	74	76
	All	70	72	71	73	70	72

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Aug	W	70	72	71	72	70	72
	AN	69	70	70	71	69	70
	BN	70	72	70	73	70	71
	D	71	72	71	72	70	72
	C	71	74	72	74	71	74
	All	70	72	71	73	70	72
Sep	W	63	64	63	65	64	66
	AN	64	65	65	66	64	65
	BN	65	67	66	68	65	67
	D	64	66	64	66	65	66
	C	66	69	66	69	66	69
	All	64	66	65	67	65	66
Oct	W	60	62	60	63	60	61
	AN	61	63	61	64	61	62
	BN	60	63	61	63	61	63
	D	59	63	60	63	60	62
	C	60	63	60	62	60	62
	All	60	63	61	63	60	62
Nov	W	54	57	54	57	54	56
	AN	55	58	55	58	55	57
	BN	54	57	55	57	54	57
	D	54	57	54	57	54	57
	C	55	58	54	57	55	57
	All	54	57	54	57	54	57
Dec	W	49	51	49	51	49	51
	AN	49	52	49	52	49	52
	BN	49	51	48	51	48	51
	D	49	51	49	51	48	50
	C	48	51	47	50	48	51
	All	49	51	49	51	49	51

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

1 **Table 5C.5.2-156. Differences[a] between the ESO Scenarios and HOS and LOS Scenarios in Mean**
2 **Monthly Water Temperature (°F) in the Feather River Low-Flow Channel (above Thermalito Afterbay)**

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	0.1 (0.1%)	0.04 (0.1%)	0 (0%)	0.1 (0.3%)
	AN	0.1 (0.2%)	-0.05 (-0.1%)	-0.1 (-0.2%)	0.1 (0.3%)
	BN	0 (0%)	-0.05 (-0.1%)	-0.1 (-0.2%)	-0.1 (-0.2%)
	D	0.1 (0.2%)	0 (0%)	-0.1 (-0.2%)	0.1 (0.3%)
	C	-0.2 (-0.3%)	0.1 (0.1%)	0.2 (0.4%)	0 (0%)
	All	0.04 (0.1%)	0 (0%)	0 (0%)	0.1 (0.1%)
Feb	W	0.03 (0.1%)	0.1 (0.1%)	0.1 (0.1%)	0.2 (0.4%)
	AN	0.1 (0.1%)	-0.1 (-0.1%)	0.05 (0.1%)	0.1 (0.3%)
	BN	0.1 (0.2%)	-0.1 (-0.2%)	0.1 (0.1%)	-0.2 (-0.3%)
	D	-0.1 (-0.1%)	-0.03 (-0.1%)	0.04 (0.1%)	0.1 (0.2%)
	C	0 (0%)	0.3 (0.5%)	0.1 (0.2%)	0.03 (0.1%)
	All	0.03 (0.1%)	0.03 (0.1%)	0.1 (0.1%)	0.1 (0.2%)
Mar	W	0 (0%)	0 (0%)	0.03 (0.1%)	0.2 (0.3%)
	AN	0.1 (0.2%)	0.1 (0.1%)	0 (0%)	0.04 (0.1%)
	BN	-0.2 (-0.4%)	-0.2 (-0.4%)	-0.2 (-0.3%)	-0.2 (-0.3%)
	D	-0.1 (-0.1%)	0.04 (0.1%)	-0.1 (-0.2%)	0.04 (0.1%)
	C	0.1 (0.1%)	0.1 (0.2%)	-0.03 (-0.1%)	-0.1 (-0.1%)
	All	-0.03 (-0.1%)	0 (0%)	-0.04 (-0.1%)	0.03 (0.1%)
Apr	W	-0.2 (-0.4%)	-0.2 (-0.3%)	0 (0%)	0.1 (0.2%)
	AN	-0.4 (-0.8%)	-1 (-0.9%)	0 (0%)	0 (0%)
	BN	-1 (-0.9%)	-0.4 (-0.7%)	0 (0%)	0 (0%)
	D	0 (0%)	0.1 (0.1%)	0.04 (0.1%)	0.04 (0.1%)
	C	0.2 (0.3%)	0.3 (0.5%)	0 (0%)	0.04 (0.1%)
	All	-0.2 (-0.3%)	-0.1 (-0.2%)	0 (0%)	0.1 (0.1%)
May	W	-0.3 (-0.5%)	-0.2 (-0.4%)	0 (0%)	0 (0%)
	AN	-1 (-0.8%)	-0.4 (-0.6%)	0.1 (0.1%)	0 (0%)
	BN	-0.4 (-0.7%)	-0.04 (-0.1%)	0 (0%)	0.1 (0.1%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0.1 (0.2%)	0.03 (0.1%)	0.1 (0.2%)
	All	-0.2 (-0.4%)	-0.1 (-0.2%)	0 (0%)	0.04 (0.1%)
Jun	W	0.4 (0.7%)	0.4 (0.6%)	0 (0%)	0.04 (0.1%)
	AN	0.3 (0.5%)	0.4 (0.6%)	0 (0%)	0 (0%)
	BN	0.3 (0.5%)	0.1 (0.2%)	-0.1 (-0.1%)	0 (0%)
	D	0.1 (0.2%)	0.1 (0.1%)	-0.04 (-0.1%)	0 (0%)
	C	0 (0%)	-0.2 (-0.3%)	-0.04 (-0.1%)	0 (0%)
	All	0.3 (0.4%)	0.2 (0.3%)	0 (0%)	0 (0%)
Jul	W	0.2 (0.2%)	0.2 (0.2%)	0 (0%)	0 (0%)
	AN	0.3 (0.5%)	0.3 (0.5%)	0 (0%)	0 (0%)
	BN	0.2 (0.2%)	0.2 (0.3%)	0 (0%)	0 (0%)
	D	0.2 (0.2%)	0.2 (0.2%)	-0.04 (-0.1%)	-0.1 (-0.1%)
	C	-0.1 (-0.2%)	-0.2 (-0.3%)	0.2 (0.3%)	-0.1 (-0.1%)
	All	0.1 (0.2%)	0.1 (0.2%)	0 (0%)	0 (0%)

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	0.4 (0.6%)	1 (0.8%)	0.1 (0.1%)	0 (0%)
	AN	1 (0.8%)	1 (1.1%)	0 (0%)	0 (0%)
	BN	0.4 (0.6%)	1 (1.5%)	0 (0%)	-0.1 (-0.2%)
	D	0.2 (0.4%)	0.1 (0.1%)	-0.1 (-0.1%)	-0.2 (-0.3%)
	C	-1 (-1%)	-1 (-1.1%)	0 (0%)	0.1 (0.1%)
	All	0.2 (0.3%)	0.3 (0.5%)	0 (0%)	-0.1 (-0.1%)
Sep	W	1 (0.9%)	1 (1.7%)	1 (2.3%)	1 (1.9%)
	AN	1 (1.5%)	2 (2.8%)	1 (1.7%)	1 (1.5%)
	BN	2 (2.6%)	2 (3.5%)	0 (0%)	-0.1 (-0.1%)
	D	-0.3 (-0.4%)	-1 (-1.5%)	-0.5 (-0.7%)	-1 (-1.3%)
	C	-1 (-1.9%)	-2 (-3.6%)	0.1 (0.1%)	-1 (-1.2%)
	All	0.3 (0.6%)	0.4 (0.6%)	0.5 (0.8%)	0.2 (0.3%)
Oct	W	1 (2%)	1 (1.2%)	-0.05 (-0.1%)	-1 (-2.2%)
	AN	1 (1.2%)	2 (3.4%)	-0.3 (-0.5%)	-1 (-0.9%)
	BN	1 (1.5%)	1 (1.4%)	0 (0%)	-1 (-1.1%)
	D	2 (2.7%)	-0.4 (-0.6%)	-0.1 (-0.2%)	-2 (-3%)
	C	-0.4 (-0.7%)	-2 (-3.9%)	-0.4 (-0.6%)	-1 (-1.4%)
	All	1 (1.6%)	0.2 (0.4%)	-0.1 (-0.2%)	-1 (-1.9%)
Nov	W	1 (1%)	-1 (-1%)	-0.3 (-0.6%)	-2 (-2.9%)
	AN	0.5 (0.8%)	1 (1.6%)	-0.1 (-0.2%)	-1 (-1.4%)
	BN	1 (1.4%)	-1 (-1%)	-0.4 (-0.7%)	-1 (-2.3%)
	D	0 (0%)	-1 (-0.9%)	-1 (-1.7%)	-1 (-1.7%)
	C	-1 (-1.3%)	-2 (-3.6%)	-0.2 (-0.4%)	-0.5 (-0.8%)
	All	0.3 (0.5%)	-1 (-1%)	-0.4 (-0.8%)	-1 (-2%)
Dec	W	0.05 (0.1%)	0.2 (0.4%)	-0.3 (-0.6%)	-0.2 (-0.4%)
	AN	0.4 (0.8%)	-0.2 (-0.3%)	-0.2 (-0.5%)	-1 (-1%)
	BN	-0.4 (-0.7%)	-0.2 (-0.4%)	-1 (-1.4%)	-0.3 (-0.6%)
	D	-0.2 (-0.3%)	0.1 (0.2%)	-1 (-1.2%)	-0.5 (-0.9%)
	C	-1 (-2.1%)	-0.4 (-0.7%)	-0.3 (-0.5%)	0.1 (0.2%)
	All	-0.2 (-0.4%)	-0.03 (-0.1%)	-0.4 (-0.8%)	-0.3 (-0.5%)

[a] Positive values indicate higher temperatures under HOS or LOS than under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-157. Differences[a] between the ESO Scenarios and HOS and LOS Scenarios in Mean Monthly Water Temperature (°F) in the Feather River High-Flow Channel (below Thermalito Afterbay)

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	0.1 (0.2%)	0.1 (0.1%)	0.1 (0.1%)	0.2 (0.4%)
	AN	0.2 (0.3%)	-0.1 (-0.1%)	0.05 (0.1%)	0.1 (0.3%)
	BN	0.3 (0.5%)	0 (0%)	-0.1 (-0.2%)	-0.03 (-0.1%)
	D	0.1 (0.1%)	-0.04 (-0.1%)	-0.1 (-0.2%)	0.1 (0.2%)
	C	-0.2 (-0.3%)	-0.1 (-0.1%)	0.2 (0.4%)	0 (0%)
	All	0.1 (0.2%)	0 (0%)	0.03 (0.1%)	0.1 (0.2%)
Feb	W	0.1 (0.3%)	0.2 (0.3%)	0.04 (0.1%)	0.2 (0.4%)
	AN	0.2 (0.5%)	-0.1 (-0.2%)	-0.03 (-0.1%)	0.05 (0.1%)
	BN	0 (0%)	-0.2 (-0.3%)	-0.1 (-0.1%)	-0.1 (-0.2%)
	D	-0.1 (-0.1%)	-0.04 (-0.1%)	0.03 (0.1%)	0.1 (0.2%)
	C	0.1 (0.1%)	0.2 (0.3%)	0.1 (0.2%)	0 (0%)
	All	0.1 (0.1%)	0 (0%)	0 (0%)	0.1 (0.1%)
Mar	W	0.04 (0.1%)	-0.1 (-0.1%)	-0.03 (-0.1%)	0.1 (0.1%)
	AN	-0.03 (-0.1%)	0 (0%)	-0.1 (-0.3%)	-0.2 (-0.5%)
	BN	-0.1 (-0.2%)	-0.2 (-0.4%)	-0.2 (-0.3%)	-0.2 (-0.3%)
	D	-0.04 (-0.1%)	0.1 (0.2%)	0.03 (0.1%)	0.1 (0.1%)
	C	-0.2 (-0.3%)	0 (0%)	-0.1 (-0.2%)	-0.1 (-0.2%)
	All	-0.05 (-0.1%)	-0.04 (-0.1%)	-0.1 (-0.1%)	-0.05 (-0.1%)
Apr	W	-1 (-1.7%)	-1 (-1.7%)	0 (0%)	0.1 (0.1%)
	AN	-1 (-2.3%)	-1 (-2.4%)	0 (0%)	0.1 (0.2%)
	BN	-2 (-2.9%)	-1 (-2%)	0.05 (0.1%)	0.1 (0.2%)
	D	-0.3 (-0.5%)	0.03 (0.1%)	0.04 (0.1%)	0.1 (0.1%)
	C	0 (0%)	0.1 (0.2%)	0.1 (0.1%)	0.1 (0.2%)
	All	-1 (-1.5%)	-1 (-1.2%)	0 (0%)	0.1 (0.2%)
May	W	-1 (-1.9%)	-1 (-1.1%)	0 (0%)	0.03 (0.1%)
	AN	-1 (-2.2%)	-1 (-1.6%)	0.1 (0.2%)	0 (0%)
	BN	-1 (-1.6%)	-0.5 (-0.8%)	0 (0%)	0.1 (0.2%)
	D	-0.2 (-0.4%)	-0.2 (-0.2%)	-0.1 (-0.1%)	-0.04 (-0.1%)
	C	0 (0%)	0.1 (0.2%)	0 (0%)	0.1 (0.1%)
	All	-1 (-1.2%)	-0.5 (-0.7%)	0 (0%)	0.04 (0.1%)
Jun	W	1 (1.1%)	1 (2.1%)	0 (0%)	0.3 (0.4%)
	AN	2 (2.4%)	2 (3.1%)	-0.1 (-0.2%)	0.04 (0.1%)
	BN	2 (2.3%)	1 (1.2%)	-0.2 (-0.4%)	0 (0%)
	D	1 (1%)	0.2 (0.2%)	-0.1 (-0.2%)	-0.1 (-0.1%)
	C	0 (0%)	0.1 (0.2%)	-0.1 (-0.1%)	0.05 (0.1%)
	All	1 (1.3%)	1 (1.4%)	-0.1 (-0.2%)	0.1 (0.1%)
Jul	W	1 (1.5%)	1 (1.8%)	0 (0%)	0.2 (0.2%)
	AN	2 (3.2%)	2 (3.3%)	0 (0.1%)	0.1 (0.2%)
	BN	1 (1.3%)	1 (1.1%)	0.2 (0.3%)	0.1 (0.2%)
	D	1 (0.9%)	0.3 (0.5%)	-0.4 (-0.6%)	-0.3 (-0.5%)
	C	-0.5 (-0.7%)	-1 (-1.2%)	0.1 (0.1%)	-0.4 (-0.5%)
	All	1 (1.2%)	1 (1.1%)	0 (0%)	-0.05 (-0.1%)

		Scenarios[c]			
Month	Water-Year Type[b]	ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	1 (1.7%)	1 (1.3%)	0.1 (0.2%)	0 (0%)
	AN	1 (1.7%)	1 (1.5%)	-0.1 (-0.1%)	0.04 (0.1%)
	BN	1 (0.8%)	1 (1.5%)	-0.3 (-0.4%)	-0.3 (-0.3%)
	D	-0.2 (-0.2%)	-0.1 (-0.2%)	-0.3 (-0.4%)	-0.3 (-0.4%)
	C	1 (0.8%)	0.4 (0.6%)	-0.1 (-0.1%)	-0.2 (-0.2%)
	All	1 (1%)	1 (0.9%)	-0.1 (-0.1%)	-0.1 (-0.2%)
Sep	W	1 (1.2%)	1 (1.9%)	1 (2.3%)	2 (2.6%)
	AN	1 (1.7%)	1 (1.7%)	-0.04 (-0.1%)	-0.2 (-0.3%)
	BN	1 (1.5%)	1 (1.4%)	0.1 (0.1%)	-0.1 (-0.1%)
	D	-0.3 (-0.5%)	0 (0%)	0.4 (0.6%)	0.04 (0.1%)
	C	0.2 (0.3%)	-0.3 (-0.4%)	-0.3 (-0.4%)	-0.2 (-0.3%)
	All	1 (0.8%)	1 (1%)	1 (0.8%)	0.5 (0.7%)
Oct	W	1 (1.1%)	0.4 (0.7%)	0.04 (0.1%)	-1 (-1.2%)
	AN	0.3 (0.6%)	1 (1.8%)	-0.1 (-0.1%)	-0.3 (-0.6%)
	BN	1 (1.4%)	1 (1%)	0.2 (0.3%)	-0.2 (-0.4%)
	D	1 (1.3%)	-0.3 (-0.4%)	0.1 (0.1%)	-1 (-1.3%)
	C	0.2 (0.2%)	-1 (-1.7%)	-0.04 (-0.1%)	-0.3 (-0.5%)
	All	1 (1%)	0.2 (0.3%)	0.04 (0.1%)	-1 (-0.9%)
Nov	W	0.3 (0.5%)	-0.3 (-0.5%)	-0.2 (-0.3%)	-1 (-1.5%)
	AN	0.1 (0.3%)	0.4 (0.7%)	-0.1 (-0.1%)	-0.4 (-0.7%)
	BN	0.4 (0.7%)	-0.2 (-0.3%)	-0.2 (-0.4%)	-1 (-0.9%)
	D	-0.1 (-0.1%)	-0.3 (-0.6%)	-0.4 (-0.8%)	-1 (-1%)
	C	-0.4 (-0.7%)	-1 (-1.8%)	-0.1 (-0.2%)	-0.2 (-0.4%)
	All	0.1 (0.2%)	-0.3 (-0.5%)	-0.2 (-0.4%)	-1 (-1%)
Dec	W	0.04 (0.1%)	0.2 (0.4%)	0 (0%)	0 (0%)
	AN	0.3 (0.5%)	-0.3 (-0.5%)	-0.1 (-0.3%)	-0.3 (-0.5%)
	BN	-0.3 (-0.7%)	-0.3 (-0.6%)	-1 (-1.1%)	0.1 (0.2%)
	D	-0.2 (-0.5%)	0.2 (0.4%)	-0.4 (-0.7%)	-0.3 (-0.5%)
	C	-0.4 (-0.8%)	-0.3 (-0.7%)	-0.1 (-0.2%)	0.1 (0.3%)
	All	-0.1 (-0.2%)	-0.03 (-0.1%)	-0.2 (-0.4%)	-0.05 (-0.1%)

[a] Positive values indicate higher temperatures under HOS or LOS than under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Water temperatures in the low-flow channel of the Feather River are determined largely by coldwater pool storage in Oroville Reservoir and instream flow releases. Reservoir storage in May and September provides an indicator of coldwater pool availability. Results of CALSIM modeling of Oroville Reservoir storage in May and September are shown in Table 5C.5.2-158 with the corresponding frequency of exceedance plots for May storage shown in Figure 5C.5.2-121 and for September storage in Figure 5C.5.2-122. Table 5C.5.2-159 presents differences in May and September storage between EBC2 and ESO scenarios. These results indicate that May and September storage in Oroville Reservoir under ESO_ELT and ESO_LLT would range from little or no difference to samall to moderate (11% to 18%) increases in reservoir storage relative to EBC2_ELT and EBC2_LLT, respectively Table 5C.5.2-159.

September Oroville storage under ESO, HOS, and LOS scenarios are presented in Table 5C.5.2-160 and differences between the ESO scenario and HOS and LOS scenarios are presented in Table 5C.5.2-161. These results indicate that there would be very few differences in Oroville storage between the ESO scenario and LOS scenario. There would be small to moderate reductions in May storage and small to moderate increases in September storage under the HOS relative to the ESO. Despite these changes, year-round water temperatures in the Feather River would not substantially changed by HOS or LOS scenarios, because mean monthly water temperatures would not differ by more than 4% from those under ESO regardless of month or water-year type (Table 5C.5.2-154 through Table 5C.5.2-157).

Table 5C.5.2-158. May and September Water Storage (Thousand Acre-Feet) in Oroville Reservoir for EBC and ESO Scenarios

	Scenario[b]					
Water-Year Type[a]	**EBC1**	**EBC2**	**EBC2_ELT**	**EBC2_LLT**	**ESO_ELT**	**ESO_LLT**
May						
Wet	3,507	3,508	3,488	3,461	3,486	3,440
Above Normal	3,497	3,498	3,438	3,341	3,386	3,305
Below Normal	3,264	3,402	3,099	2,911	3,102	2,902
Dry	2,756	2,625	2,406	2,236	2,425	2,224
Critical	1,824	1,764	1,685	1,508	1,668	1,452
All	3,053	3,005	2,913	2,795	2,907	2,771
September						
Wet	2,899	2,474	2,177	1,885	2,223	1,921
Above Normal	2,374	2,043	1,818	1,583	1,693	1,551
Below Normal	2,018	1,922	1,693	1,409	1,626	1,447
Dry	1,361	1,303	1,124	1,008	1,296	1,191
Critical	984	956	902	796	1,010	884
All	2,054	1,837	1,624	1,408	1,663	1,474

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

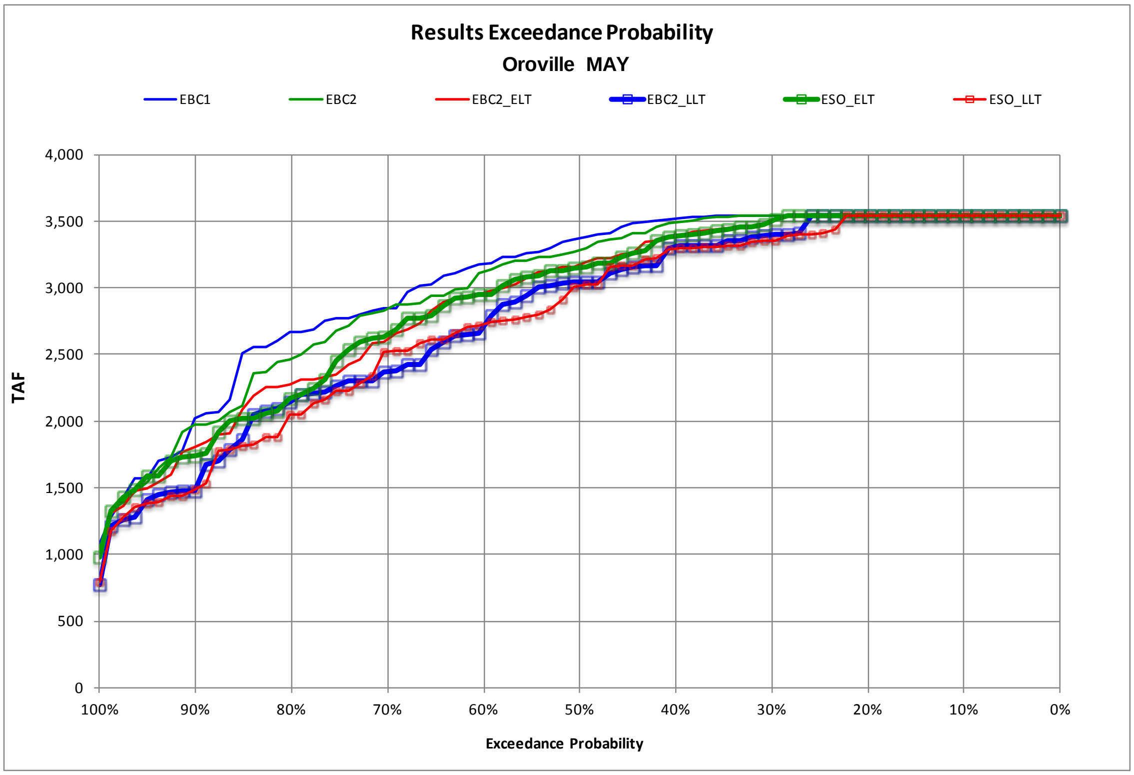


Figure 5C.5.2-121. Probability of Exceedance Plot for EBC and ESO Scenarios of Oroville Reservoir Water Storage Volume, May

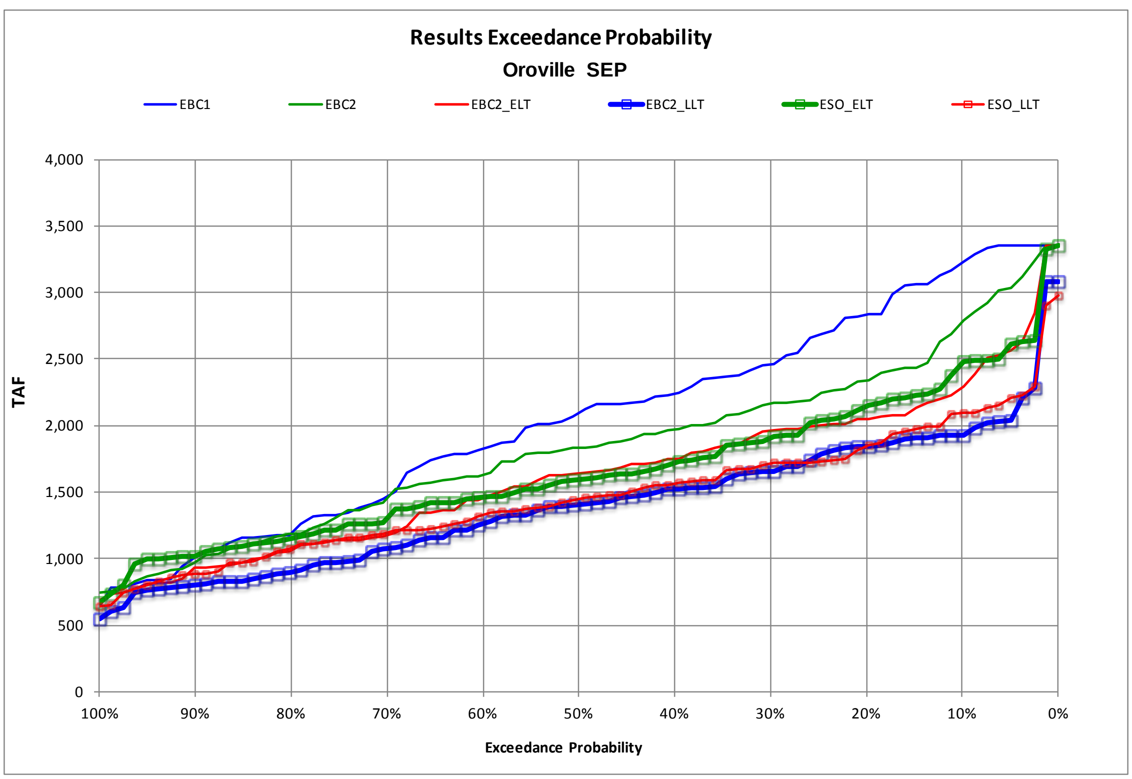


Figure 5C.5.2-122. Probability of Exceedance Plot for EBC and ESO Scenarios of Oroville Reservoir Water Storage Volume, September

Table 5C.5.2-159. Differences[a] between EBC and ESO Scenarios in May and September Water Storage (Thousand Acre-Feet) in Oroville Reservoir

Water-Year Type[b]	Scenarios[c]	
	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
May		
Wet	-2 (-0.1%)	-21 (-0.6%)
Above Normal	-52 (-1.5%)	-36 (-1.1%)
Below Normal	3 (0.1%)	-9 (-0.3%)
Dry	18 (0.8%)	-12 (-0.5%)
Critical	-17 (-1.0%)	-56 (-3.7%)
All	-6 (-0.2%)	-24 (-0.8%)
September		
Wet	46 (2.1%)	35 (1.9%)
Above Normal	-125 (-6.9%)	-32 (-2.0%)
Below Normal	-67 (-3.9%)	38 (2.7%)
Dry	173 (15.3%)	183 (18.2%)
Critical	108 (12.0%)	88 (11.1%)
All	39 (2.4%)	66 (4.7%)

[a] Negative values indicate lower storage in ESO than in EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-160. May and September Water Storage (Thousand Acre-Feet) in Oroville Reservoir under ESO, HOS, and LOS Scenarios

Water-Year Type[a]	Scenario[b]					
	ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
May						
Wet	3,486	3,440	3,108	3,066	3,488	3,442
Above Normal	3,386	3,305	2,885	2,819	3,408	3,300
Below Normal	3,102	2,902	2,651	2,511	3,183	2,979
Dry	2,425	2,224	2,426	2,293	2,618	2,392
Critical	1,668	1,452	2,092	1,824	1,699	1,535
All	2,907	2,771	2,699	2,584	2,971	2,833
September						
Wet	2,223	1,921	2,235	1,940	2,558	2,309
Above Normal	1,693	1,551	1,798	1,633	1,890	1,729
Below Normal	1,626	1,447	1,537	1,399	1,676	1,527
Dry	1,296	1,191	1,435	1,328	1,383	1,253
Critical	1,010	884	1,294	1,092	1,048	934
All	1,663	1,474	1,739	1,544	1,831	1,658

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-161. Differences[a] between ESO Scenario and HOS and LOS Scenarios in May and September Water Storage (Thousand Acre-Feet) in Oroville Reservoir

Water-Year Type[b]	Scenarios[c]			
	ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
May				
Wet	-378 (-10.8%)	-374 (-10.9%)	1 (0%)	2 (0.1%)
Above Normal	-502 (-14.8%)	-487 (-14.7%)	22 (0.7%)	-5 (-0.2%)
Below Normal	-451 (-14.5%)	-391 (-13.5%)	81 (2.6%)	77 (2.6%)
Dry	1 (0%)	69 (3.1%)	194 (8%)	167 (7.5%)
Critical	424 (25.4%)	372 (25.6%)	31 (1.8%)	83 (5.7%)
All	-208 (-7.2%)	-187 (-6.7%)	65 (2.2%)	62 (2.2%)
September				
Wet	12 (0.5%)	19 (1%)	335 (15.1%)	388 (20.2%)
Above Normal	105 (6.2%)	82 (5.3%)	197 (11.6%)	178 (11.5%)
Below Normal	-89 (-5.5%)	-48 (-3.3%)	49 (3%)	81 (5.6%)
Dry	139 (10.7%)	137 (11.5%)	86 (6.7%)	62 (5.2%)
Critical	284 (28.1%)	207 (23.4%)	38 (3.8%)	50 (5.6%)
All	76 (4.6%)	70 (4.8%)	168 (10.1%)	184 (12.5%)

[a] Negative values indicate decreased storage under HOS or LOS.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

The exceedances of monthly water temperatures above a 56°F NMFS threshold above Thermalito Afterbay, a proxy for Robinson Riffle (RM 61.6), during September through April were evaluated for steelhead spawning and egg incubation (Section 5C.4, Table 5C.4-3).

Table 5C.5.2-162 reports the percent of months during the 82-year modeling period for each month during September through April that exceeded the 56°F threshold by 1°F to 5°F in 1°F increments for each scenario. Table 5C.5.2-163 presents differences between EBC and ESO model scenarios in these percent values. Steelhead spawn and eggs incubate primarily during January through April in the Feather River. The remaining months in these tables apply to the spring-run Chinook salmon spawning and egg incubation period discussed below in the spring-run Chinook salmon eggs and alevin section (Section 5C.5.2.4.2.1). During January through April, there would be negligible differences between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. Although relative differences may be large for some months, the absolute differences would not exceed 4%, which would likely be within the range of modeling error. These results indicate that there would generally be no temperature-related effects of the ESO on steelhead spawning and egg incubation conditions in the Feather River.

Table 5C.5.2-164 presents differences between EBC2 scenarios and HOS and LOS scenarios in these percent values. In general, during the January through April steelhead spawning and egg incubation period, there are no differences in the percent of months exceeding the threshold under HOS and LOS scenarios relative to EBC2 in both ELT and LLT periods. These results indicate that there would generally be no temperature-related effects of HOS or LOS scenarios on steelhead spawning and egg incubation conditions in the Feather River.

Table 5C.5.2-162. Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River above Thermalito Afterbay Exceed the 56°F Threshold, September through April

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
EBC1					
September	100	99	91	73	41
October	22	7	6	2	2
November	2	1	1	0	0
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	1	0	0	0	0
April	9	5	0	0	0
EBC2					
September	99	99	85	63	22
October	20	10	5	2	1
November	4	1	0	0	0
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	1	0	0	0	0
April	9	5	0	0	0
EBC2_ELT					
September	100	99	98	78	46
October	49	23	17	11	9
November	10	9	5	2	1
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	2	0	0	0	0
April	20	11	4	1	0
ESO_ELT					
September	100	99	98	84	57
October	44	23	14	9	6
November	11	9	4	2	0
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	1	1	1	1	0
April	21	10	4	1	0

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
EBC2_LLT					
September	100	100	99	96	83
October	86	65	56	49	40
November	67	59	49	32	25
December	4	1	1	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	10	2	1	1	1
April	53	32	17	6	1
ESO_LLT					
September	100	100	99	98	85
October	85	67	54	48	33
November	63	57	43	35	19
December	4	2	1	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	11	2	1	1	1
April	53	28	15	7	2
HOS_ELT					
September	100	98	95	78	40
October	41	27	22	17	16
November	20	16	9	4	1
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	1	1	0	0	0
April	16	5	1	1	0
HOS_LLT					
September	100	99	98	91	80
October	68	57	47	40	38
November	48	42	31	22	15
December	2	1	1	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	6	1	1	1	0
April	36	19	14	2	1
LOS_ELT					
September	100	100	96	88	58
October	27	16	11	6	2
November	9	4	2	0	0
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	1	1	1	0	0
April	16	6	1	0	0

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
LOS_LLT					
September	100	100	100	94	86
October	62	44	37	31	22
November	43	36	23	11	7
December	2	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	5	2	1	1	0
April	41	21	12	4	1
Key:					
	0%				
	1–25%				
	26–50%				
	51–75%				
	76–100%				

Table 5C.5.2-163. Differences between EBC and ESO Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River above Thermalito Afterbay Exceed the 56°F Threshold, September through April

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
EBC1 vs. ESO_ELT					
September	0 (0%)	0 (0%)	6 (7%)	11 (15%)	16 (39%)
October	22 (100%)	16 (217%)	7 (120%)	6 (250%)	4 (150%)
November	9 (350%)	7 (600%)	2 (200%)	2 (NA)	0 (NA)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	0 (0%)	1 (NA)	1 (NA)	1 (NA)	0 (NA)
April	12 (143%)	5 (100%)	4 (NA)	1 (NA)	0 (NA)
EBC1 vs. ESO_LLT					
September	0 (0%)	1 (1%)	7 (8%)	25 (34%)	44 (109%)
October	63 (283%)	59 (800%)	48 (780%)	46 (1850%)	31 (1250%)
November	60 (2450%)	56 (4500%)	42 (3400%)	35 (NA)	19 (NA)
December	4 (NA)	2 (NA)	1 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	10 (800%)	2 (NA)	1 (NA)	1 (NA)	1 (NA)
April	44 (514%)	23 (475%)	15 (NA)	7 (NA)	2 (NA)

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
EBC2 vs. ESO_ELT					
September	1 (1%)	0 (0%)	12 (14%)	21 (33%)	35 (156%)
October	25 (125%)	14 (138%)	9 (175%)	6 (250%)	5 (400%)
November	7 (200%)	7 (600%)	4 (NA)	2 (NA)	0 (NA)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	0 (0%)	1 (NA)	1 (NA)	1 (NA)	0 (NA)
April	12 (143%)	5 (100%)	4 (NA)	1 (NA)	0 (NA)
EBC2 vs. ESO_LLT					
September	1 (1%)	1 (1%)	14 (16%)	35 (55%)	63 (283%)
October	65 (331%)	57 (575%)	49 (1000%)	46 (1850%)	32 (2600%)
November	59 (1600%)	56 (4500%)	43 (NA)	35 (NA)	19 (NA)
December	4 (NA)	2 (NA)	1 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	10 (800%)	2 (NA)	1 (NA)	1 (NA)	1 (NA)
April	44 (514%)	23 (475%)	15 (NA)	7 (NA)	2 (NA)
EBC2_ELT vs. ESO_ELT					
September	0 (0%)	0 (0%)	0 (0%)	6 (8%)	11 (24%)
October	-5 (-10%)	0 (0%)	-4 (-21%)	-2 (-22%)	-2 (-29%)
November	1 (13%)	0 (0%)	-1 (-25%)	0 (0%)	-1 (-100%)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	-1 (-50%)	1 (NA)	1 (NA)	1 (NA)	0 (NA)
April	1 (6%)	-1 (-11%)	0 (0%)	0 (0%)	0 (NA)
EBC2_LLT vs. ESO_LLT					
September	0 (0%)	0 (0%)	0 (0%)	1 (1%)	2 (3%)
October	-1 (-1%)	1 (2%)	-1 (-2%)	-1 (-3%)	-6 (-16%)
November	-4 (-6%)	-2 (-4%)	-6 (-13%)	2 (8%)	-6 (-25%)
December	0 (0%)	1 (100%)	0 (0%)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	1 (13%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
April	0 (0%)	-4 (-12%)	-2 (-14%)	1 (20%)	1 (100%)
NA = Could not calculate because dividing by 0.					

Table 5C.5.2-164. Differences between EBC2 and HOS and LOS Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River above Thermalito Afterbay Exceed the 56°F Threshold, September through April

Month	Degrees Above Threshold >1.0	>2.0	>3.0	>4.0	>5.0
EBC2_ELT vs. HOS_ELT					
September	0 (0%)	-1 (-1%)	-2 (-3%)	0 (0%)	-6 (-14%)
October	-9 (-18%)	4 (16%)	5 (29%)	6 (56%)	7 (86%)
November	10 (100%)	7 (86%)	4 (75%)	1 (50%)	0 (0%)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	-1 (-50%)	1 (NA)	0 (NA)	0 (NA)	0 (NA)
April	-4 (-19%)	-6 (-56%)	-2 (-67%)	0 (0%)	0 (NA)
EBC2_LLT vs. HOS_LLT					
September	0 (0%)	-1 (-1%)	-1 (-1%)	-5 (-5%)	-2 (-3%)
October	-19 (-21%)	-9 (-13%)	-9 (-16%)	-10 (-20%)	-1 (-3%)
November	-19 (-28%)	-17 (-29%)	-19 (-38%)	-10 (-31%)	-10 (-40%)
December	-1 (-33%)	0 (0%)	0 (0%)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	-4 (-38%)	-1 (-50%)	0 (0%)	0 (0%)	-1 (-100%)
April	-17 (-33%)	-14 (-42%)	-4 (-21%)	-4 (-60%)	0 (0%)
EBC2_ELT vs. LOS_ELT					
September	0 (0%)	1 (1%)	-1 (-1%)	10 (13%)	12 (27%)
October	-22 (-45%)	-7 (-32%)	-6 (-36%)	-5 (-44%)	-6 (-71%)
November	-1 (-13%)	-5 (-57%)	-2 (-50%)	-2 (-100%)	-1 (-100%)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	-1 (-50%)	1 (NA)	1 (NA)	0 (NA)	0 (NA)
April	-4 (-19%)	-5 (-44%)	-2 (-67%)	-1 (-100%)	0 (NA)
EBC2_LLT vs. LOS_LLT					
September	0 (0%)	0 (0%)	1 (1%)	-2 (-3%)	4 (4%)
October	-25 (-29%)	-21 (-32%)	-19 (-33%)	-19 (-38%)	-17 (-44%)
November	-23 (-35%)	-23 (-40%)	-26 (-53%)	-21 (-65%)	-17 (-70%)
December	-1 (-33%)	-1 (-100%)	-1 (-100%)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	-5 (-50%)	0 (0%)	0 (0%)	0 (0%)	-1 (-100%)
April	-12 (-23%)	-11 (-35%)	-5 (-29%)	-2 (-40%)	0 (0%)

Degree-months for months that exceed the 56°F NMFS threshold were summed for all 82 years and are presented in Table 5C.5.2-165; differences between EBC and ESO scenarios are presented in Table 5C.5.2-166. Exceedances would generally be similar between EBC2 and ESO in ELT and LLT during the January through April steelhead spawning and egg incubation period. These results indicate that there would generally be no temperature-related effects of the ESO on steelhead spawning and egg incubation conditions in the Feather River.

Differences between EBC2 scenarios and HOS and LOS scenarios in degree-months are presented in Table 5C.5.2-167. During the January through April steelhead spawning and egg incubation period, the number of degree-months under HOS and LOS scenarios would generally be similar to those under EBC2 scenarios. Although the relative changes may be large, absolute differences would be too small to have a biologically meaningful effect on steelhead and are likely within the range of model error. Therefore, these results indicate that there would be no temperature-related effects of HOS or LOS on steelhead spawning and egg incubation conditions in the Feather River.

Combined, these analyses of NMFS threshold exceedances indicate that there would be no temperature-related effects of the ESO on steelhead spawning and egg incubation conditions in the Feather River.

Table 5C.5.2-165. Total Degree-Months (°F-Months) by Month and Water-Year Type for Water Temperature Exceedances above 56°F in the Feather River above Thermalito Afterbay, September through April

Month	Water-Year Type	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Sep	W	108	83	99	133	103	138	115	164	138	167
	AN	43	34	40	53	43	57	53	75	54	66
	BN	60	56	65	91	74	99	96	129	73	97
	D	69	72	98	157	100	140	96	119	92	122
	C	65	58	76	127	75	119	59	90	75	109
	All	345	303	378	561	395	553	419	577	431	561
Oct	W	5	4	15	101	15	84	40	103	15	51
	AN	10	7	18	45	18	40	24	62	14	35
	BN	7	9	21	61	18	57	31	69	19	48
	D	7	5	28	87	19	88	45	84	16	59
	C	8	7	21	49	16	49	11	22	11	39
	All	37	32	103	343	86	318	151	340	75	231
Nov	W	0	0	1	56	0	57	12	47	0	28
	AN	3	2	6	28	6	26	9	33	7	21
	BN	1	1	5	35	3	33	13	29	3	19
	D	0	1	7	51	10	46	15	41	5	32
	C	0	0	3	28	2	26	0	9	2	23
	All	4	4	22	198	21	188	49	159	16	122
Dec	W	0	0	0	1	0	1	0	0	0	0
	AN	0	0	0	1	0	2	0	1	0	1
	BN	0	0	0	3	0	3	0	3	0	1
	D	0	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	1	0	1
	All	0	0	0	5	0	6	0	5	0	3

Month	Water-Year Type	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	0	0	0	0	0	0	0	0	0	0
	AN	0	0	0	0	0	0	0	0	0	0
	BN	0	0	0	0	0	0	0	0	0	0
	D	0	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0	0
	All	0	0	0	0	0	0	0	0	0	0
Feb	W	0	0	0	0	0	0	0	0	0	0
	AN	0	0	0	0	0	0	0	0	0	0
	BN	0	0	0	0	0	0	0	0	0	0
	D	0	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0	0
	All	0	0	0	0	0	0	0	0	0	0
Mar	W	0	0	0	0	0	0	0	0	0	0
	AN	0	0	0	0	0	0	0	0	0	0
	BN	0	0	0	2	0	2	0	3	0	2
	D	0	0	0	2	0	3	0	2	0	3
	C	1	1	2	9	4	9	3	8	4	7
	All	1	1	2	13	4	14	3	13	4	12
Apr	W	0	0	0	3	0	4	0	3	0	5
	AN	2	2	3	13	4	14	3	8	4	14
	BN	4	4	7	20	7	19	4	15	7	19
	D	5	5	12	31	11	29	12	30	12	28
	C	0	0	7	23	7	20	8	24	6	21
	All	11	11	29	90	29	86	26	79	29	88

Table 5C.5.2-166. Differences between EBC and ESO Scenarios in Total Degree-Months (°F-Months) by Month and Water-Year Type for Water Temperature Exceedances above 56°F in the Feather River above Thermalito Afterbay, September through April

Month	Water-Year Type	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Sep	W	-5 (-5%)	30 (28%)	20 (24%)	55 (66%)	4 (4%)	5 (4%)
	AN	0 (0%)	14 (33%)	9 (26%)	23 (68%)	3 (8%)	4 (8%)
	BN	14 (23%)	39 (65%)	18 (32%)	43 (77%)	9 (14%)	8 (9%)
	D	31 (45%)	71 (103%)	28 (39%)	68 (94%)	2 (2%)	-17 (-11%)
	C	10 (15%)	54 (83%)	17 (29%)	61 (105%)	-1 (-1%)	-8 (-6%)
	All	50 (14%)	208 (60%)	92 (30%)	250 (83%)	17 (4%)	-8 (-1%)
Oct	W	10 (200%)	79 (1580%)	11 (275%)	80 (2000%)	0 (0%)	-17 (-17%)
	AN	8 (80%)	30 (300%)	11 (157%)	33 (471%)	0 (0%)	-5 (-11%)
	BN	11 (157%)	50 (714%)	9 (100%)	48 (533%)	-3 (-14%)	-4 (-7%)
	D	12 (171%)	81 (1157%)	14 (280%)	83 (1660%)	-9 (-32%)	1 (1%)
	C	8 (100%)	41 (513%)	9 (129%)	42 (600%)	-5 (-24%)	0 (0%)
	All	49 (132%)	281 (759%)	54 (169%)	286 (894%)	-17 (-17%)	-25 (-7%)

Month	Water-Year Type	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Nov	W	0 (NA)	57 (NA)	0 (NA)	57 (NA)	-1 (-100%)	1 (2%)
	AN	3 (100%)	23 (767%)	4 (200%)	24 (1200%)	0 (0%)	-2 (-7%)
	BN	2 (200%)	32 (3200%)	2 (200%)	32 (3200%)	-2 (-40%)	-2 (-6%)
	D	10 (NA)	46 (NA)	9 (900%)	45 (4500%)	3 (43%)	-5 (-10%)
	C	2 (NA)	26 (NA)	2 (NA)	26 (NA)	-1 (-33%)	-2 (-7%)
	All	17 (425%)	184 (4600%)	17 (425%)	184 (4600%)	-1 (-5%)	-10 (-5%)
Dec	W	0 (NA)	1 (NA)	0 (NA)	1 (NA)	0 (NA)	0 (0%)
	AN	0 (NA)	2 (NA)	0 (NA)	2 (NA)	0 (NA)	1 (100%)
	BN	0 (NA)	3 (NA)	0 (NA)	3 (NA)	0 (NA)	0 (0%)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	All	0 (NA)	6 (NA)	0 (NA)	6 (NA)	0 (NA)	1 (20%)
Jan	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
Feb	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
Mar	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	2 (NA)	0 (NA)	2 (NA)	0 (NA)	0 (0%)
	D	0 (NA)	3 (NA)	0 (NA)	3 (NA)	0 (NA)	1 (50%)
	C	3 (300%)	8 (800%)	3 (300%)	8 (800%)	2 (100%)	0 (0%)
	All	3 (300%)	13 (1300%)	3 (300%)	13 (1300%)	2 (100%)	1 (8%)
Apr	W	0 (NA)	4 (NA)	0 (NA)	4 (NA)	0 (NA)	1 (33%)
	AN	2 (100%)	12 (600%)	2 (100%)	12 (600%)	1 (33%)	1 (8%)
	BN	3 (75%)	15 (375%)	3 (75%)	15 (375%)	0 (0%)	-1 (-5%)
	D	6 (120%)	24 (480%)	6 (120%)	24 (480%)	-1 (-8%)	-2 (-6%)
	C	7 (NA)	20 (NA)	7 (NA)	20 (NA)	0 (0%)	-3 (-13%)
	All	18 (164%)	75 (682%)	18 (164%)	75 (682%)	0 (0%)	-4 (-4%)

NA = Could not calculate because dividing by 0.

1 **Table 5C.5.2-167. Differences between EBC2 Scenarios and HOS and LOS Scenarios in Total Degree-**
2 **Months (°F-Months) by Month and Water-Year Type for Water Temperature Exceedances above 56°F**
3 **in the Feather River at above Thermalito Afterbay, September through April**

Month	Water-Year Type	EBC2_ELT vs. HOS_ELT	EBC2_LLT vs. HOS_LLT	EBC2_ELT vs. LOS_ELT	EBC2_LLT vs. LOS_LLT
Sep	W	16 (16%)	31 (23%)	39 (39%)	34 (26%)
	AN	13 (33%)	22 (42%)	14 (35%)	13 (25%)
	BN	31 (48%)	38 (42%)	8 (12%)	6 (7%)
	D	-2 (-2%)	-38 (-24%)	-6 (-6%)	-35 (-22%)
	C	-17 (-22%)	-37 (-29%)	-1 (-1%)	-18 (-14%)
	All	41 (11%)	16 (3%)	53 (14%)	0 (0%)
Oct	W	25 (167%)	2 (2%)	0 (0%)	-50 (-50%)
	AN	6 (33%)	17 (38%)	-4 (-22%)	-10 (-22%)
	BN	10 (48%)	8 (13%)	-2 (-10%)	-13 (-21%)
	D	17 (61%)	-3 (-3%)	-12 (-43%)	-28 (-32%)
	C	-10 (-48%)	-27 (-55%)	-10 (-48%)	-10 (-20%)
	All	48 (47%)	-3 (-1%)	-28 (-27%)	-112 (-33%)
Nov	W	11 (1100%)	-9 (-16%)	-1 (-100%)	-28 (-50%)
	AN	3 (50%)	5 (18%)	1 (17%)	-7 (-25%)
	BN	8 (160%)	-6 (-17%)	-2 (-40%)	-16 (-46%)
	D	8 (114%)	-10 (-20%)	-2 (-29%)	-19 (-37%)
	C	-3 (-100%)	-19 (-68%)	-1 (-33%)	-5 (-18%)
	All	27 (123%)	-39 (-20%)	-6 (-27%)	-76 (-38%)
Dec	W	0 (NA)	-1 (-100%)	0 (NA)	-1 (-100%)
	AN	0 (NA)	0 (0%)	0 (NA)	0 (0%)
	BN	0 (NA)	0 (0%)	0 (NA)	-2 (-67%)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	0 (NA)	1 (NA)	0 (NA)	1 (NA)
	All	0 (NA)	0 (0%)	0 (NA)	-2 (-40%)
Jan	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)	0 (NA)	0 (NA)
Feb	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)	0 (NA)	0 (NA)

Month	Water-Year Type	EBC2_ELT vs. HOS_ELT	EBC2_LLT vs. HOS_LLT	EBC2_ELT vs. LOS_ELT	EBC2_LLT vs. LOS_LLT
Mar	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	1 (50%)	0 (NA)	0 (0%)
	D	0 (NA)	0 (0%)	0 (NA)	1 (50%)
	C	1 (50%)	-1 (-11%)	2 (100%)	-2 (-22%)
	All	1 (50%)	0 (0%)	2 (100%)	-1 (-8%)
Apr	W	0 (NA)	0 (0%)	0 (NA)	2 (67%)
	AN	0 (0%)	-5 (-38%)	1 (33%)	1 (8%)
	BN	-3 (-43%)	-5 (-25%)	0 (0%)	-1 (-5%)
	D	0 (0%)	-1 (-3%)	0 (0%)	-3 (-10%)
	C	1 (14%)	1 (4%)	-1 (-14%)	-2 (-9%)
	All	-3 (-10%)	-11 (-12%)	0 (0%)	-2 (-2%)

Redd Dewatering

Ramping rates for releases on the Feather River are included as part of routine operations and would be expected to remain the same in the future under BDCP. Flows in the low-flow channel are maintained to avoid redd dewatering. Redd dewatering risks would not occur for months when flows during the egg incubation period were at or greater than flows in the month when spawning occurred. Monthly CALSIM modeling predicts that flows between January and April encompassing the steelhead spawning period would be maintained at levels that would minimize and avoid the risk of dewatering steelhead redds in the low-flow channel under all model scenarios and, therefore, there would be no effect of ESO, HOS, and LOS scenarios on redd dewatering (Table 5C.5.2-121, Table 5C.5.2-122, Figure 5C.5.2-97 through Figure 5C.5.2-100).

5C.5.2.4.1.2 Fry and Juvenile Rearing

Rearing Habitat

Although there is relatively little natural steelhead production in the Feather River, most steelhead spawning and rearing appears to occur in the low-flow channel in habitats associated with well-vegetated side channels (Cavallo et al. 2003; California Department of Water Resources 2004). Because these habitats are relatively uncommon, they could limit natural steelhead production. The river channel downstream of Thermalito (high-flow channel) offers few of the habitat types upon which steelhead appear to rely in the low-flow channel. Experiments and fish observations also suggest that predation risk for juvenile steelhead is higher downstream of the Thermalito outlet (California Department of Water Resources 2004). Increased predation risk is likely a function of water temperature, where warm water nonnative species such as striped bass, largemouth bass, and smallmouth bass are more prevalent, and in general, predators have greater metabolic requirements. Thus, summer temperatures that exceed 65°F and the absence of preferred steelhead habitat currently appear to limit steelhead rearing in the river downstream of the Thermalito outlet.

Flows in the low-flow channel under ESO, HOS, and LOS scenarios are projected to remain between 700 and 800 cfs year-round except during occasional flood control releases (Table 5C.5.2-121, Table 5C.5.2-122, Table 5C.5.2-125, Table 5C.5.2-126, Figure 5C.5.2-97 through Figure 5C.5.2-108). This flow regime is less than pre-dam levels during all months of the year as a result of water diversions through the Thermalito Afterbay. The significance of these flow conditions for steelhead spawning and rearing is uncertain. Feather River rotary screw trap data suggest that Chinook salmon initiate emigration regardless of flow regime (i.e., they do not wait for a high-flow pulse). This is likely true for steelhead, as well.

Some habitat exists on the Feather River high-flow channel downstream of Thermalito Afterbay for steelhead spawning and rearing. Flows in the high-flow channel are greater and substantially more variable than those in the low-flow channel, which contributes to greater habitat diversity and complexity. Flows in the high-flow channel under ESO_ELT and ESO_LLT would generally be greater than or similar to those under EBC2_ELT and EBC2_LLT, respectively, in all months except July through September (Table 5C.5.2-123, Table 5C.5.2-124, and Figure 5C.5.2-109 through Figure 5C.5.2-120). During July through September, flows under ESO_ELT and ESO_LLT would be up to 50% lower than those under EBC2_ELT and EBC2_LLT depending on month, water-year type and comparison.

Flows in the low-flow channel under HOS and LOS scenarios would not be different from those under ESO (Table 5C.5.2-125, Table 5C.5.2-126). Flows in the high-flow channel under HOS would generally be similar to or greater than flows under ESO during January through May, but would be substantially lower (up to 42% lower) during June through December (Table 5C.5.2-127, Table 5C.5.2-128). Flows under LOS in the high-flow channel would generally be similar to or greater than flows under ESO throughout the year, except for substantial reductions (52% to 83% lower) in wet and above normal water years during September. These reduced flows under HOS and LOS are expected to reduce the value and quantity of steelhead rearing habitat in the high-flow channel, although the overwhelming majority of juvenile steelhead do not rear in this section of the Feather River (Cavallo et al. 2003; California Department of Water Resources 2004).

Juvenile steelhead rear within the Feather River year-round. It was assumed that habitat for juvenile steelhead rearing in the Feather River would be constrained by the month having the lowest instream flows because juvenile rearing habitat increases as instream flows increase above minimum levels. CALSIM predicts that the lowest average monthly instream flow in the low-flow channel was 700 cfs for all model scenarios (Table 5C.5.2-121). Based on these results, it was concluded that juvenile steelhead rearing habitat, as measured by minimum instream flows, would not be affected by the ESO.

As reported in the spawning and egg section, there would be no differences in monthly mean temperatures in the Feather River between any model scenario at any time of year (Table 5C.5.2-168 and Table 5C.5.2-169). In addition, as requested by NMFS, the exceedances of monthly water temperatures above a 63°F threshold above Thermalito Afterbay, a proxy for Robinson Riffle (RM 61.6),_during May through August and above a 56°F threshold at Gridley, a proxy for Gridley Bridge, during October through April were evaluated for steelhead juvenile rearing conditions (Section 5C.4, Table 5C.4-3).

Table 5C.5.2-168 reports the percent of months during the 82-year modeling period for each month during May through August that exceeded the 63°F threshold above Thermalito Afterbay by 1°F to 5°F in 1°F increments for each scenario. Table 5C.5.2-169 presents differences between EBC and ESO scenarios in these percent values. Table 5C.5.2-170 presented differences between EBC2 scenarios and HOS and LOS scenarios in these percent values. Table 5C.5.2-171, Table 5C.5.2-172, and Table 5C.5.2-173 report these same results for the 56°F threshold at Gridley during October through April.

Above Thermalito Afterbay, exceedances above the 63°F threshold would be greatest during July and lowest during May (Table 5C.5.2-168). Exceedances under EBC2_ELT and ESO_LLT would generally be similar to or up to 9% lower (30% lower on a relative scale) than those under EBC2_ELT and EBC2_LLT, respectively, during May through July Table 5C.5.2-169. During August, the percent of months exceeding the threshold under ESO_ELT and ESO_LLT would be similar to or up to 9% higher (15% higher on a relative scale) than the percent under EBC2_ELT and EBC2_LLT, respectively, depending on the number of degrees above the threshold. Exceedances under HOS and LOS scenarios would be similar to or up to 22% lower (78% lower on a relative scale) than those under EBC2 scenarios (Table 5C.5.2-170).

At Gridley, exceedances above the 56°F threshold would be greatest during April and October and lowest during January and February (Table 5C.5.2-171. Exceedances under ESO_ELT and ESO_LLT would generally be similar to or up to 6% lower (33% on a relative scale) than those under EBC2_ELT and EBC2_LLT, respectively (Table 5C.5.2-172). Exceedances under HOS and LOS scenarios would generally be similar to or up to 21% lower (34% on a relative scale) than those under EBC2 (Table 5C.5.2-173).

Table 5C.5.2-168. Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River above Thermalito Afterbay Exceed the 63°F Threshold, May through August

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
EBC1					
May	0	0	0	0	0
June	56	27	5	0	0
July	100	100	99	73	40
August	100	88	58	28	10
EBC2					
May	0	0	0	0	0
June	52	23	4	0	0
July	100	100	99	77	40
August	100	88	58	28	11
EBC2_ELT					
May	4	1	0	0	0
June	79	54	28	4	0
July	100	100	100	99	74
August	100	99	80	54	30
ESO_ELT					
May	4	2	0	0	0
June	75	47	20	4	0
July	100	100	100	99	75
August	100	99	85	54	36
EBC2_LLT					
May	6	2	1	0	0
June	89	78	47	21	5
July	100	100	100	99	94
August	100	100	99	81	57

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
ESO_LLT					
May	6	2	1	0	0
June	86	73	43	17	5
July	100	100	100	100	93
August	100	100	99	88	65
HOS_ELT					
May	2	0	0	0	0
June	65	44	16	2	0
July	100	100	99	94	68
August	100	99	80	51	22
HOS_LLT					
May	2	1	0	0	0
June	81	58	38	15	4
July	100	100	100	98	90
August	100	100	99	81	58
LOS_ELT					
May	2	0	0	0	0
June	57	32	6	1	0
July	100	100	99	89	64
August	100	96	74	43	20
LOS_LLT					
May	2	2	0	0	0
June	81	54	28	7	2
July	100	100	100	98	86
August	100	100	94	77	51

Key:	
	0%
	1–25%
	26–50%
	51–75%
	76–100%

Table 5C.5.2-169. Differences between EBC and ESO Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River above Thermalito Afterbay Exceed the 63°F Threshold, May through August

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
EBC1 vs. ESO_ELT					
May	4 (NA)	2 (NA)	0 (NA)	0 (NA)	0 (NA)
June	20 (36%)	20 (73%)	15 (300%)	4 (NA)	0 (NA)
July	0 (0%)	0 (0%)	1 (1%)	26 (36%)	36 (91%)
August	0 (0%)	11 (13%)	27 (47%)	26 (91%)	26 (263%)
EBC1 vs. ESO_LLT					
May	6 (NA)	2 (NA)	1 (NA)	0 (NA)	0 (NA)
June	31 (56%)	46 (168%)	38 (775%)	17 (NA)	5 (NA)
July	0 (0%)	0 (0%)	1 (1%)	27 (37%)	53 (134%)
August	0 (0%)	12 (14%)	41 (70%)	59 (209%)	56 (563%)
EBC2 vs. ESO_ELT					
May	4 (NA)	2 (NA)	0 (NA)	0 (NA)	0 (NA)
June	23 (45%)	23 (100%)	16 (433%)	4 (NA)	0 (NA)
July	0 (0%)	0 (0%)	1 (1%)	22 (29%)	36 (91%)
August	0 (0%)	11 (13%)	27 (47%)	26 (91%)	25 (222%)
EBC2 vs. ESO_LLT					
May	6 (NA)	2 (NA)	1 (NA)	0 (NA)	0 (NA)
June	35 (67%)	49 (211%)	40 (1067%)	17 (NA)	5 (NA)
July	0 (0%)	0 (0%)	1 (1%)	23 (31%)	53 (134%)
August	0 (0%)	12 (14%)	41 (70%)	59 (209%)	54 (489%)
EBC2_ELT vs. ESO_ELT					
May	0 (0%)	1 (100%)	0 (NA)	0 (NA)	0 (NA)
June	-4 (-5%)	-7 (-14%)	-9 (-30%)	0 (0%)	0 (NA)
July	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (2%)
August	0 (0%)	0 (0%)	5 (6%)	0 (0%)	6 (21%)
EBC2_LLT vs. ESO_LLT					
May	0 (0%)	0 (0%)	0 (0%)	0 (NA)	0 (NA)
June	-2 (-3%)	-5 (-6%)	-4 (-8%)	-4 (-18%)	0 (0%)
July	0 (0%)	0 (0%)	0 (0%)	1 (1%)	-1 (-1%)
August	0 (0%)	0 (0%)	0 (0%)	6 (8%)	9 (15%)
NA = Could not calculate because dividing by 0.					

Table 5C.5.2-170. Differences between EBC2 Scenarios and HOS and LOS Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River above Thermalito Afterbay Exceed the 63°F Threshold, May through August

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
EBC2_ELT vs. HOS_ELT					
May	-1 (-33%)	-1 (-100%)	0 (NA)	0 (NA)	0 (NA)
June	-14 (-17%)	-10 (-18%)	-12 (-43%)	-1 (-33%)	0 (NA)
July	0 (0%)	0 (0%)	-1 (-1%)	-5 (-5%)	-6 (-8%)
August	0 (0%)	0 (0%)	0 (0%)	-4 (-7%)	-7 (-25%)
EBC2_LLT vs. HOS_LLT					
May	-4 (-60%)	-1 (-50%)	-1 (-100%)	0 (NA)	0 (NA)
June	-7 (-8%)	-20 (-25%)	-9 (-18%)	-6 (-29%)	-1 (-25%)
July	0 (0%)	0 (0%)	0 (0%)	-1 (-1%)	-4 (-4%)
August	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (2%)
EBC2_ELT vs. LOS_ELT					
May	-1 (-33%)	-1 (-100%)	0 (NA)	0 (NA)	0 (NA)
June	-22 (-28%)	-22 (-41%)	-22 (-78%)	-2 (-67%)	0 (NA)
July	0 (0%)	0 (0%)	-1 (-1%)	-10 (-10%)	-10 (-13%)
August	0 (0%)	-2 (-3%)	-6 (-8%)	-11 (-20%)	-10 (-33%)
EBC2_LLT vs. LOS_LLT					
May	-4 (-60%)	0 (0%)	-1 (-100%)	0 (NA)	0 (NA)
June	-7 (-8%)	-23 (-30%)	-19 (-39%)	-14 (-65%)	-2 (-50%)
July	0 (0%)	0 (0%)	0 (0%)	-1 (-1%)	-7 (-8%)
August	0 (0%)	0 (0%)	-5 (-5%)	-5 (-6%)	-6 (-11%)
NA = Could not calculate because dividing by 0.					

Table 5C.5.2-171. Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River at Gridley Exceed the 56°F Threshold, October through April

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
EBC1					
October	98	86	73	41	19
November	4	1	0	0	0
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	7	4	1	0	0
April	70	57	31	17	11
EBC2					
October	96	91	65	46	25
November	5	0	0	0	0
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	9	5	2	0	0
April	69	56	30	16	10
EBC2_ELT					
October	99	95	84	67	49
November	16	6	2	1	0
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	19	9	5	2	1
April	79	68	51	30	16
ESO_ELT					
October	98	94	84	65	44
November	17	6	2	0	0
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	22	9	5	1	1
April	79	69	51	30	19
EBC2_LLT					
October	100	100	96	89	78
November	62	41	32	19	6
December	1	1	0	0	0
January	0	0	0	0	0
February	4	0	0	0	0
March	44	28	11	7	4
April	90	80	73	59	38
ESO_LLT					
October	100	100	100	91	81
November	65	42	26	12	5

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
December	1	0	0	0	0
January	0	0	0	0	0
February	4	1	0	0	0
March	46	31	12	7	4
April	90	80	70	59	38
HOS_ELT					
October	99	94	78	63	44
November	16	10	4	0	0
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	10	6	4	1	0
April	59	51	33	20	10
HOS_LLT					
October	100	99	95	83	73
November	47	32	21	11	7
December	1	0	0	0	0
January	0	0	0	0	0
February	1	0	0	0	0
March	32	17	9	5	2
April	65	58	52	41	26
LOS_ELT					
October	96	90	75	54	36
November	7	2	0	0	0
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	9	7	4	1	0
April	77	64	43	23	14
LOS_LLT					
October	100	99	94	79	72
November	41	26	12	6	4
December	0	0	0	0	0
January	0	0	0	0	0
February	1	0	0	0	0
March	33	19	7	5	2
April	83	75	64	53	32

Key:

	0%
	1–25%
	26–50%
	51–75%
	76–100%

1

Table 5C.5.2-172. Differences between EBC and ESO Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River at Gridley Exceed the 56°F Threshold, October through April

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
EBC1 vs. ESO_ELT					
October	0 (0%)	7 (9%)	11 (15%)	25 (61%)	26 (140%)
November	14 (367%)	5 (400%)	2 (NA)	0 (NA)	0 (NA)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	15 (200%)	5 (133%)	4 (300%)	1 (NA)	1 (NA)
April	9 (12%)	12 (22%)	20 (64%)	12 (71%)	7 (67%)
EBC1 vs. ESO_LLT					
October	2 (3%)	14 (16%)	27 (37%)	51 (124%)	63 (340%)
November	62 (1667%)	41 (3300%)	26 (NA)	12 (NA)	5 (NA)
December	1 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	4 (NA)	1 (NA)	0 (NA)	0 (NA)	0 (NA)
March	38 (517%)	27 (733%)	11 (900%)	7 (NA)	4 (NA)
April	20 (28%)	23 (41%)	40 (128%)	42 (243%)	27 (244%)
EBC2 vs. ESO_ELT					
October	1 (1%)	2 (3%)	19 (28%)	20 (43%)	20 (80%)
November	12 (250%)	6 (NA)	2 (NA)	0 (NA)	0 (NA)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	14 (157%)	4 (75%)	2 (100%)	1 (NA)	1 (NA)
April	10 (14%)	14 (24%)	21 (71%)	14 (85%)	9 (88%)
EBC2 vs. ESO_LLT					
October	4 (4%)	9 (9%)	35 (53%)	46 (100%)	57 (230%)
November	60 (1225%)	42 (NA)	26 (NA)	12 (NA)	5 (NA)
December	1 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	4 (NA)	1 (NA)	0 (NA)	0 (NA)	0 (NA)
March	37 (429%)	26 (525%)	10 (400%)	7 (NA)	4 (NA)
April	21 (30%)	25 (44%)	41 (138%)	43 (269%)	28 (288%)
EBC2_ELT vs. ESO_ELT					
October	-1 (-1%)	-1 (-1%)	0 (0%)	-1 (-2%)	-5 (-10%)
November	1 (8%)	0 (0%)	0 (0%)	-1 (-100%)	0 (NA)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	4 (20%)	0 (0%)	0 (0%)	-1 (-50%)	0 (0%)
April	0 (0%)	1 (2%)	0 (0%)	0 (0%)	2 (15%)

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
EBC2_LLT vs. ESO_LLT					
October	0 (0%)	0 (0%)	4 (4%)	2 (3%)	4 (5%)
November	4 (6%)	1 (3%)	-6 (-19%)	-6 (-33%)	-1 (-20%)
December	0 (0%)	-1 (-100%)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (0%)	1 (NA)	0 (NA)	0 (NA)	0 (NA)
March	1 (3%)	2 (9%)	1 (11%)	0 (0%)	0 (0%)
April	0 (0%)	0 (0%)	-2 (-3%)	0 (0%)	0 (0%)
NA = Could not calculate because dividing by 0.					

Table 5C.5.2-173. Differences between EBC2 Scenarios and HOS and LOS Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River at Gridley Exceed the 56°F Threshold, October through April

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
EBC2_ELT vs. HOS_ELT					
October	0 (0%)	-1 (-1%)	-6 (-7%)	-4 (-6%)	-5 (-10%)
November	0 (0%)	4 (60%)	1 (50%)	-1 (-100%)	0 (NA)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	-9 (-47%)	-2 (-29%)	-1 (-25%)	-1 (-50%)	-1 (-100%)
April	-20 (-25%)	-17 (-25%)	-17 (-34%)	-10 (-33%)	-6 (-38%)
EBC2_LLT vs. HOS_LLT					
October	0 (0%)	-1 (-1%)	-1 (-1%)	-6 (-7%)	-5 (-6%)
November	-15 (-24%)	-9 (-21%)	-11 (-35%)	-7 (-40%)	1 (20%)
December	0 (0%)	-1 (-100%)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	-2 (-67%)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	-12 (-28%)	-11 (-39%)	-2 (-22%)	-2 (-33%)	-1 (-33%)
April	-25 (-27%)	-22 (-28%)	-21 (-29%)	-19 (-31%)	-12 (-32%)
EBC2_ELT vs. LOS_ELT					
October	-2 (-3%)	-5 (-5%)	-9 (-10%)	-12 (-19%)	-14 (-28%)
November	-9 (-54%)	-4 (-60%)	-2 (-100%)	-1 (-100%)	0 (NA)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	-10 (-53%)	-1 (-14%)	-1 (-25%)	-1 (-50%)	-1 (-100%)
April	-2 (-3%)	-4 (-5%)	-7 (-15%)	-6 (-21%)	-2 (-15%)

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
EBC2_LLT vs. LOS_LLT					
October	0 (0%)	-1 (-1%)	-2 (-3%)	-10 (-11%)	-6 (-8%)
November	-21 (-34%)	-15 (-36%)	-20 (-62%)	-12 (-67%)	-2 (-40%)
December	-1 (-100%)	-1 (-100%)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	-2 (-67%)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	-11 (-25%)	-10 (-35%)	-4 (-33%)	-2 (-33%)	-1 (-33%)
April	-7 (-8%)	-5 (-6%)	-9 (-12%)	-6 (-10%)	-6 (-16%)
NA = Could not calculate because dividing by 0.					

Degree-months for months that exceed the 63°F threshold were summed for all 82 years in the Feather River above Thermalito Afterbay, a proxy for Robinson Riffle, and are presented in Table 5C.5.2-174; differences between model EBC and ESO scenarios are presented in Table 5C.5.2-175. Exceedances would generally be similar between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT except during June, in which exceedances would be 9% to 19% lower in wetter water-year types, and during August, in which exceedances would be 5% to 8% higher in wetter water-year types and 5% to 11% lower in drier water-year types. Combining these results with those from the percent of months exceeding the threshold above (Table 5C.5.2-168, Table 5C.5.2-169), the increased exceedances of the threshold during August would occur primarily in wetter water years when conditions are less stressful to steelhead juveniles and would be lower in drier water years.

Differences between EBC2 scenarios and HOS and LOS scenarios in degree-months are presented in Table 5C.5.2-176. There would be neglible or small to moderate reductions in total degree-months under HOS and LOS scenarios relative to EBC2 scenarios during through May through July. The largest reductions would be under HOS_ELT relative to EBC2_ELT during July. During August, there would be a small to moderate increase in total degree-months under HOS_ELT relative to EBC2_ELT. There would be no differences in total degree-months under HOS_LLT relative to EBC2_LLT, or either LOS scenario relative to EBC2_ELT or EBC2_LLT, repectively, except in wet water years, in which degree-months would be up to 9% higher (7% on a relative scale).

Table 5C.5.2-174. Total Degree-Months (°F-Months) by Month and Water-Year Type for Water Temperature Exceedances above 63°F in the Feather River above Thermalito Afterbay, May through August

Month	Water-Year Type	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
May	W	0	0	0	1	0	1	0	1	0	1
	AN	0	0	1	1	1	1	0	1	1	1
	BN	0	0	0	0	0	0	0	0	0	0
	D	0	0	1	2	2	2	0	2	2	2
	C	0	0	2	4	2	4	0	4	2	4
	All	0	0	4	8	5	8	0	5	4	8
June	W	15	13	32	44	26	39	0	39	25	40
	AN	14	13	22	31	20	27	0	27	19	27
	BN	13	13	26	35	20	33	0	31	18	31
	D	23	19	38	56	36	54	1	53	34	53
	C	6	6	16	31	16	32	2	29	15	29
	All	71	64	134	197	118	185	3	193	111	180
Jul	W	120	120	143	161	144	163	35	163	141	163
	AN	44	43	54	64	53	64	22	64	53	64
	BN	59	59	74	87	74	86	24	86	74	86
	D	71	72	90	107	90	109	37	111	90	110
	C	52	57	70	84	74	90	16	91	77	90
	All	346	351	431	503	435	512	133	525	435	513
Aug	W	89	84	99	122	106	132	145	131	106	131
	AN	25	24	32	43	34	45	57	46	34	46
	BN	38	37	52	67	53	71	76	70	52	68
	D	40	46	64	93	68	88	94	87	64	83
	C	42	44	62	82	56	73	73	74	54	75
	All	234	235	309	407	317	409	444	435	310	403

Table 5C.5.2-175. Differences between EBC and ESO Scenarios in Total Degree-Months (°F-Months) by Month and Water-Year Type for Water Temperature Exceedances above 63°F in the Feather River above Thermalito Afterbay, May through August

Month	Water-Year Type	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
May	W	0 (NA)	1 (NA)	0 (NA)	1 (NA)	0 (NA)	0 (0%)
	AN	1 (NA)	1 (NA)	1 (NA)	1 (NA)	0 (0%)	0 (0%)
	BN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	D	2 (NA)	2 (NA)	2 (NA)	2 (NA)	1 (100%)	0 (0%)
	C	2 (NA)	4 (NA)	2 (NA)	4 (NA)	0 (0%)	0 (0%)
	All	5 (NA)	8 (NA)	5 (NA)	8 (NA)	1 (25%)	0 (0%)
June	W	11 (73%)	24 (160%)	13 (100%)	26 (200%)	-6 (-19%)	-5 (-11%)
	AN	6 (43%)	13 (93%)	7 (54%)	14 (108%)	-2 (-9%)	-4 (-13%)
	BN	7 (54%)	20 (154%)	7 (54%)	20 (154%)	-6 (-23%)	-2 (-6%)
	D	13 (57%)	31 (135%)	17 (89%)	35 (184%)	-2 (-5%)	-2 (-4%)
	C	10 (167%)	26 (433%)	10 (167%)	26 (433%)	0 (0%)	1 (3%)
	All	47 (66%)	114 (161%)	54 (84%)	121 (189%)	-16 (-12%)	-12 (-6%)
Jul	W	24 (20%)	43 (36%)	24 (20%)	43 (36%)	1 (1%)	2 (1%)
	AN	9 (20%)	20 (45%)	10 (23%)	21 (49%)	-1 (-2%)	0 (0%)
	BN	15 (25%)	27 (46%)	15 (25%)	27 (46%)	0 (0%)	-1 (-1%)
	D	19 (27%)	38 (54%)	18 (25%)	37 (51%)	0 (0%)	2 (2%)
	C	22 (42%)	38 (73%)	17 (30%)	33 (58%)	4 (6%)	6 (7%)
	All	89 (26%)	166 (48%)	84 (24%)	161 (46%)	4 (1%)	9 (2%)
Aug	W	17 (19%)	43 (48%)	22 (26%)	48 (57%)	7 (7%)	10 (8%)
	AN	9 (36%)	20 (80%)	10 (42%)	21 (88%)	2 (6%)	2 (5%)
	BN	15 (39%)	33 (87%)	16 (43%)	34 (92%)	1 (2%)	4 (6%)
	D	28 (70%)	48 (120%)	22 (48%)	42 (91%)	4 (6%)	-5 (-5%)
	C	14 (33%)	31 (74%)	12 (27%)	29 (66%)	-6 (-10%)	-9 (-11%)
	All	83 (35%)	175 (75%)	82 (35%)	174 (74%)	8 (3%)	2 (0.5%)

NA = Could not calculate because dividing by 0.

Table 5C.5.2-176. Differences between EBC2 Scenarios and HOS and LOS Scenarios in Total Degree-Months (°F-Months) by Month and Water-Year Type for Water Temperature Exceedances above 63°F in the Feather River above Thermalito Afterbay, May through August

Month	Water-Year Type	EBC2_ELT vs. HOS_ELT	EBC2_LLT vs. HOS_LLT	EBC2_ELT vs. LOS_ELT	EBC2_LLT vs. LOS_LLT
May	W	0 (NA)	0 (0%)	0 (NA)	0 (0%)
	AN	-1 (-100%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	D	-1 (-100%)	0 (0%)	1 (100%)	0 (0%)
	C	-2 (-100%)	0 (0%)	0 (0%)	0 (0%)
	All	-4 (-100%)	0 (0%)	1 (25%)	0 (0%)
June	W	-32 (-100%)	-5 (-11%)	-7 (-22%)	-4 (-9%)
	AN	-22 (-100%)	-4 (-13%)	-3 (-14%)	-4 (-13%)
	BN	-26 (-100%)	-4 (-11%)	-8 (-31%)	-4 (-11%)
	D	-37 (-97%)	-3 (-5%)	-4 (-11%)	-3 (-5%)
	C	-14 (-88%)	-2 (-6%)	-1 (-6%)	-2 (-6%)
	All	-131 (-98%)	-18 (-9%)	-23 (-17%)	-17 (-9%)
Jul	W	-108 (-76%)	2 (1%)	-2 (-1%)	2 (1%)
	AN	-32 (-59%)	0 (0%)	-1 (-2%)	0 (0%)
	BN	-50 (-68%)	-1 (-1%)	0 (0%)	-1 (-1%)
	D	-53 (-59%)	4 (4%)	0 (0%)	3 (3%)
	C	-54 (-77%)	7 (8%)	7 (10%)	6 (7%)
	All	-297 (-69%)	12 (2%)	4 (1%)	10 (2%)
Aug	W	46 (46%)	9 (7%)	7 (7%)	9 (7%)
	AN	25 (78%)	3 (7%)	2 (6%)	3 (7%)
	BN	24 (46%)	3 (4%)	0 (0%)	1 (1%)
	D	30 (47%)	-6 (-6%)	0 (0%)	-10 (-11%)
	C	11 (18%)	-8 (-10%)	-8 (-13%)	-7 (-9%)
	All	136 (44%)	1 (0.2%)	1 (0.3%)	-4 (-1%)

Degree-months for months in October through ppril that exceed the 56°F threshold were summed for all 82 years in the Feather River at Gridley and are presented in Table 5C.5.2-177; differences between EBC2 and ESO scenarios are presented in Table 5C.5.2-178. Differences between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT for all months and water-year types would be very small (<10 month-degrees over the 82-year period) on an absolute scale and not biologically meaningful to steelhead fry and juveniles despite sizeable (up to 100%) relative differences. Relative differences are large due low values under EBC2 scenarios and, therefore are, not meaningful.

Difference between EBC2 scenarios and HOS and LOS scenarios are presented in (Table 5C.5.2-179). The number of degree-months above the threshold under HOS and LOS scenarios would generally similar to or lower by up to 48% than under EBC2 scenarios depending on month and water-year type, except during October under HOS_ELT, in which the threshold would be exceeded by 30 more degree-months (8% higher) for all water-year types combined relative to EBC2_ELT. These results indicate that there would generally be no negative temperature-related effects of HOS or LOS on fry and juvenile rearing habitat at Gridley during this period. Instead, temperature conditions would improve during April under HOS and during October and November under LOS.

Overall, these analyses of NMFS threshold exceedances indicate that there would generally be no temperature-related effects of the ESO, HOS, or LOS on juvenile steelhead rearing habitat in the Feather River with small benefits in some months and water-year types and a small adverse effect during wetter water years during August.

Table 5C.5.2-177. Total Degree-Months (°F-Months) by Month and Water-Year Type for Water Temperature Exceedances above 56°F in the Feather River at Gridley, October through April

Month	Water-Year Type	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Oct	W	73	79	107	175	105	171	120	179	105	151
	AN	44	44	58	80	56	79	59	88	54	74
	BN	55	57	72	104	68	104	79	110	70	99
	D	53	52	75	124	74	127	84	123	71	113
	C	41	41	59	85	59	88	59	74	57	83
	All	266	273	371	568	362	569	401	575	357	519
Nov	W	0	0	1	37	1	37	8	34	2	24
	AN	2	1	5	21	5	21	5	25	5	18
	BN	1	1	4	22	4	21	8	23	4	15
	D	0	1	6	31	6	25	10	24	4	19
	C	1	1	5	19	5	21	3	14	4	18
	All	4	4	21	130	21	125	34	120	19	94
Dec	W	0	0	0	0	0	0	0	0	0	0
	AN	0	0	0	0	0	0	0	0	0	0
	BN	0	0	0	2	0	1	0	1	0	0
	D	0	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0	0
	All	0	0	0	2	0	1	0	1	0	0
Jan	W	0	0	0	0	0	0	0	0	0	0
	AN	0	0	0	0	0	0	0	0	0	0
	BN	0	0	0	0	0	0	0	0	0	0
	D	0	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0	0
	All	0	0	0	0	0	0	0	0	0	0
Feb	W	0	0	0	0	0	0	0	0	0	0
	AN	0	0	0	0	0	0	0	0	0	0
	BN	0	0	0	1	0	2	0	0	0	0
	D	0	0	0	0	0	1	0	0	0	1
	C	0	0	0	2	0	1	0	2	0	2
	All	0	0	0	3	0	4	0	2	0	2
Mar	W	0	0	1	5	1	5	1	6	1	5
	AN	1	1	0	3	1	4	0	2	0	1
	BN	1	3	7	22	8	24	4	18	5	20
	D	4	5	11	27	11	28	11	28	11	26
	C	4	4	10	21	10	21	10	21	10	20
	All	10	13	29	78	31	82	25	74	26	73

Month	Water-Year Type	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Apr	W	14	13	29	52	30	51	19	33	30	52
	AN	23	22	31	50	32	50	19	30	33	49
	BN	40	38	46	65	46	61	24	41	47	62
	D	49	47	65	90	67	91	65	91	68	90
	C	29	28	40	60	43	62	43	62	43	61
	All	155	148	211	317	218	315	170	257	220	314

Table 5C.5.2-178. Differences between EBC and ESO Scenarios in Total Degree-Months (°F-Months) by Month and Water-Year Type for Water Temperature Exceedances above 56°F in the Feather River at Gridley, October through April

Month	Water-Year Type	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Oct	W	32 (44%)	98 (134%)	26 (33%)	92 (116%)	-2 (-2%)	-4 (-2%)
	AN	12 (27%)	35 (80%)	12 (27%)	35 (80%)	-2 (-3%)	-1 (-1%)
	BN	13 (24%)	49 (89%)	11 (19%)	47 (82%)	-4 (-6%)	0 (0%)
	D	21 (40%)	74 (140%)	22 (42%)	75 (144%)	-1 (-1%)	3 (2%)
	C	18 (44%)	47 (115%)	18 (44%)	47 (115%)	0 (0%)	3 (4%)
	All	96 (36%)	303 (114%)	89 (33%)	296 (108%)	-9 (-2%)	1 (0%)
Nov	W	1 (NA)	37 (NA)	1 (NA)	37 (NA)	0 (0%)	0 (0%)
	AN	3 (150%)	19 (950%)	4 (400%)	20 (2000%)	0 (0%)	0 (0%)
	BN	3 (300%)	20 (2000%)	3 (300%)	20 (2000%)	0 (0%)	-1 (-5%)
	D	6 (NA)	25 (NA)	5 (500%)	24 (2400%)	0 (0%)	-6 (-19%)
	C	4 (400%)	20 (2000%)	4 (400%)	20 (2000%)	0 (0%)	2 (11%)
	All	17 (425%)	121 (3025%)	17 (425%)	121 (3025%)	0 (0%)	-5 (-4%)
Dec	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	1 (NA)	0 (NA)	1 (NA)	0 (NA)	-1 (-50%)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	All	0 (NA)	1 (NA)	0 (NA)	1 (NA)	0 (NA)	-1 (-50%)
Jan	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
Feb	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	2 (NA)	0 (NA)	2 (NA)	0 (NA)	1 (100%)
	D	0 (NA)	1 (NA)	0 (NA)	1 (NA)	0 (NA)	1 (NA)
	C	0 (NA)	1 (NA)	0 (NA)	1 (NA)	0 (NA)	-1 (-50%)
	All	0 (NA)	4 (NA)	0 (NA)	4 (NA)	0 (NA)	1 (33%)

Month	Water-Year Type	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Mar	W	1 (NA)	5 (NA)	1 (NA)	5 (NA)	0 (0%)	0 (0%)
	AN	0 (0%)	3 (300%)	0 (0%)	3 (300%)	1 (NA)	1 (33%)
	BN	7 (700%)	23 (2300%)	5 (167%)	21 (700%)	1 (14%)	2 (9%)
	D	7 (175%)	24 (600%)	6 (120%)	23 (460%)	0 (0%)	1 (4%)
	C	6 (150%)	17 (425%)	6 (150%)	17 (425%)	0 (0%)	0 (0%)
	All	21 (210%)	72 (720%)	18 (138%)	69 (531%)	2 (7%)	4 (5%)
Apr	W	16 (114%)	37 (264%)	17 (131%)	38 (292%)	1 (3%)	-1 (-2%)
	AN	9 (39%)	27 (117%)	10 (45%)	28 (127%)	1 (3%)	0 (0%)
	BN	6 (15%)	21 (53%)	8 (21%)	23 (61%)	0 (0%)	-4 (-6%)
	D	18 (37%)	42 (86%)	20 (43%)	44 (94%)	2 (3%)	1 (1%)
	C	14 (48%)	33 (114%)	15 (54%)	34 (121%)	3 (8%)	2 (3%)
	All	63 (41%)	160 (103%)	70 (47%)	167 (113%)	7 (3%)	-2 (-1%)

Table 5C.5.2-179. Differences between EBC2 Scenarios and HOS and LOS Scenarios in Total Degree-Months (°F-Months) by Month and Water-Year Type for Water Temperature Exceedances above 56°F in the Feather River at Gridley, October through April

Month	Water-Year Type	EBC2_ELT vs. HOS_ELT	EBC2_LLT vs. HOS_LLT	EBC2_ELT vs. LOS_ELT	EBC2_LLT vs. LOS_LLT
Oct	W	13 (12%)	4 (2%)	-2 (-2%)	-24 (-14%)
	AN	1 (2%)	8 (10%)	-4 (-7%)	-6 (-8%)
	BN	7 (10%)	6 (6%)	-2 (-3%)	-5 (-5%)
	D	9 (12%)	-1 (-1%)	-4 (-5%)	-11 (-9%)
	C	0 (0%)	-11 (-13%)	-2 (-3%)	-2 (-2%)
	All	30 (8%)	7 (1%)	-14 (-4%)	-49 (-9%)
Nov	W	7 (700%)	-3 (-8%)	1 (100%)	-13 (-35%)
	AN	0 (0%)	4 (19%)	0 (0%)	-3 (-14%)
	BN	4 (100%)	1 (5%)	0 (0%)	-7 (-32%)
	D	4 (67%)	-7 (-23%)	-2 (-33%)	-12 (-39%)
	C	-2 (-40%)	-5 (-26%)	-1 (-20%)	-1 (-5%)
	All	13 (62%)	-10 (-8%)	-2 (-10%)	-36 (-28%)
Dec	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	-1 (-50%)	0 (NA)	-2 (-100%)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	All	0 (NA)	-1 (-50%)	0 (NA)	-2 (-100%)
Jan	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)	0 (NA)	0 (NA)

Month	Water-Year Type	EBC2_ELT vs. HOS_ELT	EBC2_LLT vs. HOS_LLT	EBC2_ELT vs. LOS_ELT	EBC2_LLT vs. LOS_LLT
Feb	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	-1 (-100%)	0 (NA)	-1 (-100%)
	D	0 (NA)	0 (NA)	0 (NA)	1 (NA)
	C	0 (NA)	0 (0%)	0 (NA)	0 (0%)
	All	0 (NA)	-1 (-33%)	0 (NA)	-1 (-33%)
Mar	W	0 (0%)	1 (20%)	0 (0%)	0 (0%)
	AN	0 (NA)	-1 (-33%)	0 (NA)	-2 (-67%)
	BN	-3 (-43%)	-4 (-18%)	-2 (-29%)	-2 (-9%)
	D	0 (0%)	1 (4%)	0 (0%)	-1 (-4%)
	C	0 (0%)	0 (0%)	0 (0%)	-1 (-5%)
	All	-4 (-14%)	-4 (-5%)	-3 (-10%)	-5 (-6%)
Apr	W	-10 (-34%)	-19 (-37%)	1 (3%)	0 (0%)
	AN	-12 (-39%)	-20 (-40%)	2 (6%)	-1 (-2%)
	BN	-22 (-48%)	-24 (-37%)	1 (2%)	-3 (-5%)
	D	0 (0%)	1 (1%)	3 (5%)	0 (0%)
	C	3 (8%)	2 (3%)	3 (8%)	1 (2%)
	All	-41 (-19%)	-60 (-19%)	9 (4%)	-3 (-1%)

5C.5.2.4.1.3 Adult

Water Temperature

Water temperature modeling (Reclamation Temperature Model) predicts that mean monthly water temperatures in the Feather River low-flow and high-flow channels would not differ in any month or water-year type between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT (Table 5C.5.2-150 through Table 5C.5.2-153). Further, there would be no differences in mena monthly water temperatures in the Feather River between the ESO scenario and HOS and LOS scenarios (Table 5C.5.2-154 through Table 5C.5.2-157). This indicates that there would be no temperature-related effects of ESO, HOS, or LOS scenarios on steelhead adults holding in the Feather River.

5C.5.2.4.2 Spring-Run

5C.5.2.4.2.1 Eggs and Alevins

Upstream Spawning Habitat

The primary habitat for spring-run Chinook salmon in the Feather River is in the low-flow channel upstream of Thermalito Afterbay. Spring-run Chinook salmon also return to the Feather River Fish Hatchery where they are spawned, incubated, and reared. Spring-run Chinook salmon eggs are subject to potential effects of ESO operations on habitat conditions affecting incubation success through (1) changes in seasonal water temperatures or instream flows within the low-flow channel that result in increased or decreased egg mortality; and (2) redd dewatering as a result of flow reductions after the redd has been constructed and the eggs are incubating, which exposes the eggs to dewatering and increased mortality.

Minimum flows in the Feather River low-flow channel are included in the FERC hydroelectric relicensing settlement agreement for the Feather River Oroville Dam (FERC Project No. 2100) and would be met for all model scenarios, including HOS and LOS scenarios, during the September through January spring-run spawning and egg incubation period (Table 5C.5.2-121, Table 5C.5.2-125). Instream flows in the low-flow channel are managed by releases from Oroville Dam and remain relatively stable among months and water years to meet habitat requirements for salmon spawning and rearing. Results of IFIM studies conducted on the Feather River showed that spawning habitat was maximized at flows of approximately 700 to 800 cfs. These results indicate that physical habitat for spawning and egg incubation in the Feather River would not differ among any model scenarios.

Water Temperature

Spring-run Chinook salmon spawning and egg incubation occurs in the reach of the Feather River low-flow channel downstream from Oroville Dam to approximately the Thermalito Afterbay. The geographic distribution of spawning and egg incubation varies depending on a variety of factors, including suitable water depths, velocities, spawning substrate, and seasonal water temperature regimes. Water temperature modeling (Reclamation Temperature Model) predicts that mean monthly water temperatures in the Feather River low-flow channel would not differ in any month or water-year type between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT (Table 5C.5.2-150 and Table 5C.5.2-152). Also, mean monthly water temperatures in the low-flow channel throughout the year under HOS and LOS scenarios would not differ from those under ESO regardless of month or water-year type (Table 5C.5.2-154 and Table 5C.5.2-156).

Table 5C.5.2-162, Table 5C.5.2-163, and Table 5C.5.2-164 report results of the analysis to determine the percent of months during the 82-year modeling period for each month during the September through January spring-run Chinook salmon spawning and egg incubation period that exceeded the 56°F threshold by >1°F to >5°F in 1°F increments for each scenario in the Feather River above Thermalito Afterbay. Additional months in these tables (February through April) correspond to steelhead spawning and egg incubation discussed in Section 5C.5.2.4.1.1. The percent of months exceeding the threshold during September through January would be highly variable depending on month and number of degrees exceeding the threshold. In general, differences in the percent of months exceeding the threshold between EBC2 and ESO scenarios during the ELT and LLT would be negligible (<5% on an absolute scale), although there would be some small increases (up to 11% on an absolute scale) and decreases (up to 6% on an absolute scale) for some degree categories and months. Differences in the percent of months exceeding the threshold between EBC2 and HOS scenarios would generally be negligible (<5% on an absolute scale) or the percent of months would be lower under HOS (up to 19% lower on an absolute scale), although the percent of months would be higher by up to 7% (absolute scale) under HOS_ELT relative to EBC2_ELT during October for most degrees above the threshold and as high as 10% in November. Differences in the percent of months exceeding the threshold between EBC2 and LOS scenarios would generally be negligible (<5% on an absolute scale) or the percent of months would be lower under LOS (up to 26% lower on an absolute scale), although the percent of months would be 10% to 12% higher (absolute scale) under LOS_ELT relative to EBC2_ELT during September for the >4.0 and >5.0 degrees above the threshold categories.

Degree-months for months that exceed the 56°F NMFS threshold during the September through January spring-run Chinook salmon spawning and egg incubationperiod were summed for all 82 years and are presented in Table 5C.5.2-165 differences between EBC and ESO scenarios are presented in Table 5C.5.2-166 above. These results indicate that, combining all water-year types, there would be no difference in exceedances between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT during September, December, and January and small (5% to 17%) reductions in exceedances during October and November. Reductions in exceedances under the ESO during October and November would correspond to a small benefit of the ESO to temperature-related spring-run Chinook salmon spawning and egg incubation conditions in the Feather River.

Differences between EBC2 scenarios and HOS and LOS scenarios in degree-months are presented in Table 5C.5.2-167. During September, exceedances above the threshold under HOS_ELT and LOS_ELT would be 41 (11%) and 53 (14%) degree-months greater, respectively, relative to EBC2_ELT. During October, exceedances above the threshold would be 48 degree-months (47%) higher under HOS_ELT and 28 degree-months (55%) lower under LOS_ELT relative to EBC2_ELT. There would be no difference in exceedances between EBC2_LLT and HOS_LLT in either month. There would be no difference in exceedances between EBC2_LLT and HOS_LLT during September, but exceedances under LOS_LLT would be 112 degree-months (33%) lower relative to EBC2_LLT during October. During November, there would be 27% to 38% fewer degree-months under HOS_ELT and HOS_LLT than under EBC2_ELT and EBC2_LLT, respectively. There would be 123% more and 20% fewer degree-months under LOS_ELT and LOS_LLT relativbe to EBC2_ELT and EBC2_LLT, respectively. Although relatiuve differences appear to be large (up to 123%), absolute differences are small (mostly under 40 degree-months) and not biologically meaningful. Combined, these analyses of NMFS threshold exceedances indicate that there would be both small beneficial and small adverse effects of the ESO, HOS, and LOS on temperature-related spring-run Chinook salmon spawning and egg incubation conditions in the Feather River.

Redd Dewatering

No analytical tools exist for quantitatively assessing the effects of flow reduction in the Feather River following spring-run Chinook salmon spawning that would result in a risk of redd dewatering during egg incubation. It was assumed that spring-run Chinook salmon spawn in the Feather River in September, and that a reduction in instream flows of greater than 5% during the following October through January (representing the egg incubation period) would result in an increased risk of redd dewatering. Redd dewatering risks would not occur for months when flows during the egg incubation period were at or greater than flows in the month when spawning occurred. Results from CALSIM indicate that instream flows in October through January (800 cfs) would be equal to or greater than the spawning flows in September (773 cfs), and these temporal increases in flows would be consistent among all model scenarios (Table 5C.5.2-121). Thus, it was concluded that there would be no difference in the risk of redd dewatering between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. Due to similarities in flows between the ESO scenario and HOS and LOS scenarios in the low-flow channel, the analysis of redd dewatering risk was not conducted for HOS and LOS (Table 5C.5.2-125, Table 5C.5.2-126).

5C.5.2.4.2.2 Fry and Juvenile Rearing

Rearing Habitat

Spring-run Chinook salmon juveniles are present in the Feather River both above (low-flow channel) and below Thermalito Afterbay (high-flow channel) from November through June. Constant flows in the low-flow channel would be similar among model scenarios during the November through June juvenile rearing period, (Table 5C.5.2-121, Table 5C.5.2-122, Figure

5C.5.2-97 through Figure 5C.5.2-102 and Figure 5C.5.2-107 through Figure 5C.5.2-108). Flows in the high-flow channel at Thermalito Afterbay under the ESO_ELT and ESO_LLT during November through June would generally be greater than flows under EBC2_ELT and EBC2_LLT, respectively (Table 5C.5.2-123, Table 5C.5.2-124, Figure 5C.5.2-109 through Figure 5C.5.2-114 and Figure 5C.5.2-119 through Figure 5C.5.2-120).

Flows under HOS and LOS scenarios would not be different from flows under ESO in the low-flow channel (Table 5C.5.2-125, Table 5C.5.2-126). Flows in the high-flow channel under LOS during November through June juvenile rearing period would not be different than flows under ESO (Table 5C.5.2-127, Table 5C.5.2-128). Flows under HOS in the high-flow channel would generally be lower than flows under ESO during November and June and flows under HOS during December and January through May would generally be similar to or greater than flows under ESO because, after export curtailments, Oroville releases would be a primary mechanism to meet the spring outflow requirement of HOS. This would cause an overall very minor negative effect to spring-run Chinook salmon juveniles rearing in the high-flow channel under the HOS.

As reported above, there would be no differences in mean monthly temperatures in the Feather River between any model scenario at any time of year (Table 5C.5.2-150 through Table 5C.5.2-157). Further, the NMFS 63°F temperature exceedance analyses above Thermalito Afterbay, a proxy for Robinson's Riffle, during May through August would generally be similar between EBC2 scenarios and ESO, HOS, and LOS scenarios with small benefits and adverse effects predicted in some months and water-year types (Table 5C.5.2-168, Table 5C.5.2-169, and Table 5C.5.2-170; Table 5C.5.2-174, Table 5C.5.2-175, and Table 5C.5.2-176).

5C.5.2.4.2.3 Adult

Water Temperature

Water temperature modeling (Reclamation Temperature Model) predicts that water temperatures in the Feather River low-flow and high-flow channels would not differ in any month or water-year type between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT (Table 5C.5.2-150 through Table 5C.5.2-153). Further, mean monthly water temperatures in the high-flow and low-flow channels under HOS and LOS scenarios would not be different from those under ESO (Table 5C.5.2-154 through Table 5C.5.2-157). This indicates that there would be no temperature-related effects on spring-run adults holding in the Feather River.

5C.5.2.4.3 Fall-Run/Late Fall–Run

5C.5.2.4.3.1 Eggs and Alevins

Upstream Spawning Habitat

The Feather River supports a population of naturally reproducing fall-run Chinook salmon that use the low-flow and high-flow channel reaches of the river for spawning, egg incubation, juvenile rearing, and upstream and downstream migration habitat. Fall-run Chinook salmon also return to the Feather River Fish Hatchery where they are spawned and mature.

Fall-run Chinook salmon spawning and egg incubation occurs primarily during October through January in the reach of the Feather River low-flow channel downstream from Oroville Dam to the vicinity of Thermalito Afterbay. Spawning also occurs in the high-flow channel starting typically in

November. The geographic distribution of spawning and incubation varies depending on a variety of factors, including the availability of suitable water depths, velocities, and substrate for spawning, and seasonal water temperature regimes.

Average flows by month and water-year type for each model scenario are presented in Table 5C.5.2-121 for the low-flow channel and Table 5C.5.2-123 for the high-flow channel. Differences between pairs of model scenarios are presented in Table 5C.5.2-122 for the low-flow channel and in Table 5C.5.2-124 for the high-flow channel. Monthly frequency of flow exceedance plots during the October through January fall-run Chinook salmon spawning and egg incubation period are presented in Figure 5C.5.2-97 and Figure 5C.5.2-106 through Figure 5C.5.2-108 for the low-flow channel. Flow exceedance plots are presented for the high-flow channel in Figure 5C.5.2-109 and Figure 5C.5.2-118 through Figure 5C.5.2-120.

Results of CALSIM modeling show that instream flows in the Feather River low-flow channel during the October through January period would be the same for all modeled scenarios and water-year types (Table 5C.5.2-121; Table 5C.5.2-122; Figure 5C.5.2-97 and Figure 5C.5.2-106 through Figure 5C.5.2-108). Flows are predicted to range from 700 to 800 cfs under all conditions. Therefore, BDCP implementation is not expected to affect physical habitat conditions for fall-run spawning and egg incubation within the Feather River low-flow channel.

Flows in the high-flow channel under ESO_ELT and ESO_LLT during October through January would generally be greater than or similar to those under EBC2_ELT and EBC2_LLT, respectively, with few small to moderate flow reductions during some months and water-year types (Table 5C.5.2-123, Table 5C.5.2-124, Figure 5C.5.2-109 and Figure 5C.5.2-118 through Figure 5C.5.2-120). Compared to the frequent increases in flows during the period, these flow reductions are infrequent enough to have no biologically meaningful effects on fall-run Chinook salmon eggs.

Flows in the low-flow channel under HOS and LOS during October through January would not be different than flows under ESO (Table 5C.5.2-125, Table 5C.5.2-126). Flows in the high-flow channel under HOS during January would generally be greater than flows under ESO; however, flows during October through December would generally be lower than flows under ESO. This indicates that there would be small to moderate negative effects of the HOS scenario on fall-run spawning and egg incubation habitat in the high-flow channel.

Water Temperature

Fall-run salmon spawn in the late fall (October through January), when seasonal air temperatures in the Oroville area are declining and habitat conditions for fall-run salmon spawning are generally improving. Suitable water temperatures for successful egg incubation depend on the temperature of water released to the river from Oroville Dam, the rate of instream flow, and atmospheric conditions that result in river warming as the water travels downstream from the dam. Monthly mean temperatures by water-year type in the low-flow and high-flow channels are presented in Table 5C.5.2-150 and Table 5C.5.2-151, respectively, and differences between pairs of model scenarios are presented in Table 5C.5.2-152 and Table 5C.5.2-153, respectively. Water temperatures under ESO_ELT and ESO_LLT at both locations would be similar to temperatures under EBC2_ELT and EBC2_LLT, respectively, throughout the period regardless of water-year type.). Further, temperatures in the high-flow and low-flow channels under HOS and LOS scenarios would not be different from those under ESO (Table 5C.5.2-154 through Table 5C.5.2-157).

The exceedances of monthly water temperatures above a 56°F threshold at Gridley, a proxy for the Gridley Bridge, during October through April were evaluated for fall-run Chinook salmon spawning conditions in addition to steelhead juvenile rearing conditions (Table 5C.5.2-171, Table 5C.5.2-172, and Table 5C.5.2-173). These results indicate that there are no biologically meaningful differences in exceedances between EBC2 and ESO scenarios, and small to moderate beneficial effects of LOS and HOS scenarios.

The Reclamation egg mortality model for the Feather River has been developed for fall-run Chinook seasonal timing and spawning distribution. The actual geographic distribution of spawning varies among years and can affect egg mortality. Depending on the abundance of spawning adults and other factors, a substantial portion of the spawning and rearing by fall-run Chinook salmon may take place in the high-flow channel. Results of the fall-run Chinook salmon egg mortality estimates are summarized in Table 5C.5.2-180. Egg mortality is predicted to increase through time (EBC2 vs. EBC2_ELT vs. EBC2_LLT), but would not change (<5% difference) due to the ESO in any water-year type (EBC2_ELT vs. ESO_ELT and EBC2_LLT vs. ESO_LLT). Averaging across water-year types, egg mortality is predicted to be similar between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. These results indicate that there would be no effect of the ESO on fall-run Chinook salmon egg mortality in the Feather River.

Table 5C.5.2-180. Egg Mortality Percentages for Fall-Run Chinook in the Feather River under EBC and ESO Scenarios

	Scenario[a]					
Water-Year Type	**EBC1**	**EBC2**	**EBC2_ELT**	**EBC2_LLT**	**ESO_ELT**	**ESO_LLT**
Wet	1.4	1.4	2.7	20.5	2.9	20.8
Above Normal	1.1	1.1	2.3	13.6	2.7	15.6
Below Normal	1.8	1.9	3.1	14.9	3.7	15.3
Dry	2.2	2.4	6.4	21.0	5.0	18.1
Critical	4.9	4.7	10.8	28.3	10.3	25.8
All	2.1	2.2	4.7	19.9	4.6	19.3

Source: Reclamation egg mortality model.
[a] See Table 5C.0-1 for definitions of the scenarios.

Redd Dewatering

Instream flows in the Feather River low-flow channel are maintained at 800 cfs under all model scenarios, including HOS and LOS (Table 5C.5.2-121, Table 5C.5.2-125). Ramping rates are part of routine operations. The stability of these flows is expected to minimize or avoid the risk of redd dewatering under both existing biological conditions and proposed project operations.

Flow fluctuations do occur in the high-flow channel during fall-run Chinook salmon egg incubation. To evaluate the potential risk of redd dewatering for fall-run, it was assumed that they spawn in October and that the eggs and alevins incubate through January. Results of monthly CALSIM flows were used to determine the magnitude of flow reduction that would occur each month during the incubation period compared to the flow in October when spawning was assumed to occur. Redd dewatering risks would not occur for months when flows during the egg incubation period were at or greater than flows in October, the month when spawning occurred. The index of risk for redd dewatering is based on the greatest percentage change (reduction) in flows in any month during the egg incubation period when compared to the flows during the month spawning was assumed to occur. Results of the flow analyses for the risk of redd dewatering are summarized in Table 5C.5.2-181. Differences between pairs of modeling scenarios are presented in Table 5C.5.2-182. Results indicate that the greatest reductions would generally be of higher magnitude (up to 20% higher on an absolute scale depending on water-year type) under ESO_ELT and ESO_LLT relative to EBC2_ELT and EBC2_LLT, respectively. This represents a negative effect of ESO, although the large majority of Chinook salmon spawn in the low flow channel (Cavallo et al. 2003) and, as a result, the effect would be very minor to the entire population.

Results of the flow analyses for the risk of redd dewatering for HOS and LOS scenarios are summarized in Table 5C.5.2-183 and differences relative to the ESO are presented in Table 5C.5.2-184. These results indicate that the greatest reductions would generally be of higher magnitude (worse) (up to 20% higher on an absolute scale depending on water-year type) under HOS and LOS (except under LOS_LLT). This represents a negative effect of HOS and LOS scenarios, although the large majority of Chinook salmon spawn in the low flow channel (Cavallo et al. 2003) and, as a result, the effect would be very minor to the entire population.

Table 5C.5.2-181. Greatest Monthly Reduction (Percentage Change) in Flow in the Feather River High-Flow Channel during the October through January Fall-Run Chinook Salmon Spawning and Egg Incubation Period under EBC and ESO Scenarios[a, b]

Water-Year Type	Scenario[c]					
	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Wet	-58	-54	-51	-58	-58	-58
Above Normal	-54	-47	-41	-43	-58	-58
Below Normal	-66	-55	-47	-58	-58	-58
Dry	-61	-54	-58	-58	-78	-70
Critical	-65	-66	-55	-60	-52	-68

[a] A negative value indicates a reduction in flows.
[b] Redd dewatering risk not applicable for months when flows during the egg incubation period were at or greater than flows in the month when spawning is assumed to occur.
[c] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-182. Differences[a] between EBC and ESO Scenarios in Greatest Monthly Reduction (Percentage Change) in Flow in the Feather River High-Flow Channel during the October through January Fall-Run Chinook Salmon Spawning and Egg Incubation Period[b]

Water-Year Type	Scenario[c]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Wet	0 (0%)	0 (0%)	-4 (-7%)	-4 (-7%)	-7 (-13%)	0 (0%)
Above Normal	-3 (-6%)	-3 (-6%)	-10 (-21%)	-10 (-21%)	-16 (-39%)	-15 (-35%)
Below Normal	9 (13%)	9 (13%)	-2 (-4%)	-2 (-4%)	-11 (-23%)	0 (0%)
Dry	-16 (-27%)	-9 (-14%)	-23 (-43%)	-16 (-29%)	-20 (-35%)	-13 (-22%)
Critical	12 (19%)	-3 (-5%)	14 (21%)	-2 (-3%)	3 (5%)	-8 (-13%)

[a] A negative value indicates that the greatest monthly reduction would be larger (worse) under the ESO than under the EBC.
[b] Redd dewatering risk not applicable for months when flows during the egg incubation period were at or greater than flows in the month when spawning is assumed to occur.
[c] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-183. Greatest Monthly Reduction (Percentage Change) in Flow in the Feather River High-Flow Channel during the October through January Fall-Run Chinook Salmon Spawning and Egg Incubation Period under ESO, HOS, and LOS Scenarios[a, b]

Water-Year Type	Scenario[b]					
	ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Wet	-58	-58	-70	-67	-64	-61
Above Normal	-58	-58	-63	-58	-66	-58
Below Normal	-58	-58	-70	-78	-59	-58
Dry	-78	-70	-78	-58	-78	-70
Critical	-52	-68	-64	-68	-67	-68

[a] A negative value indicates a reduction in flows.
[b] Redd dewatering risk not applicable for months when flows during the egg incubation period were at or greater than flows in the month when spawning is assumed to occur.
[c] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-184. Differences[a] between ESO Scenarios and HOS and LOS Scenarios in Greatest Monthly Reduction (Percentage Change) in Flow in the Feather River High-Flow Channel during the October through January Fall-Run Chinook Salmon Spawning and Egg Incubation Period[b]

Water-Year Type	Scenarios[c]			
	ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Wet	-13 (-22%)	-10 (-17%)	-7 (-10%)	-4 (-5%)
Above Normal	-5 (-9%)	0 (0%)	-8 (-14%)	0 (0%)
Below Normal	-13 (-22%)	-20 (-35%)	-1 (-2%)	0 (0%)
Dry	0 (0%)	13 (18%)	0 (0%)	0 (0%)
Critical	-12 (-22%)	0 (0%)	-15 (-23%)	0 (0%)

[a] A negative value indicates that the greatest monthly reduction would be larger (worse) under HOS or LOS than under ESO.
[b] Redd dewatering risk not applicable for months when flows during the egg incubation period were at or greater than flows in the month when spawning is assumed to occur.
[c] See Table 5C.0-1 for definitions of the scenarios.

5C.5.2.4.3.2 Fry and Juvenile Rearing

Rearing Habitat

Fall-run Chinook juveniles are present in the Feather River in December through June, with peak rearing occurring primarily between January and May. Instream flows in the Feather River low-flow channel during the juvenile fall-run Chinook salmon rearing period are predicted to be identical (700 to 800 cfs) for all model scenarios, including HOS and LOS (Table 5C.5.2-121, Table 5C.5.2-125). Therefore, it was concluded that there would be no effects of the ESO, HOS, and LOS scenarios on physical habitat characteristics (e.g., water depth, velocity, wetted cross sectional area) within the low-flow channel.

Mean monthly water temperatures throughout the low-flow channel would also be suitable for rearing (lower than 65°F) through this period under all scenarios, including HOS and LOS scenarios (Table 5C.5.2-151, Table 5C.5.2-154). The constant flows in the low-flow channel would be unchanged among all model scenarios and would therefore not be higher under the ESO, HOS, or LOS relative to existing biological conditions in all months and water-year types between December and June (Table 5C.5.2-152 and Table 5C.5.2-156). This change in flow timing is closer to a natural hydrograph and should benefit fall-run Chinook salmon.

Monthly mean temperatures by water-year type in the low-flow and high-flow channels are presented in Table 5C.5.2-150 and Table 5C.5.2-151, respectively, and differences between pairs of model scenarios are presented in Table 5C.5.2-152 and Table 5C.5.2-153, respectively. Mean monthly water temperatures during December through June under ESO_ELT and ESO_LLT at both locations would be similar to temperatures under EBC2_ELT and EBC2_LLT, respectively, throughout the period regardless of water-year type. Further, there would be no differences in the high-flow or low-flow channels in mean monthly water temperatures between HOS and LOS scenarios and the ESO during December through June (Table 5C.5.2-154 through Table 5C.5.2-157). These results indicate that ESO, HOS, and LOS scenarios would have no temperature-related effects on fall-run juvenile rearing.

5C.5.2.4.3.3 Adult

Water Temperature

Adult fall-run Chinook salmon generally migrate upstream in the Feather River during August through December prior to spawning. Monthly mean temperatures by water-year type in the low-flow and high-flow channels are presented in Table 5C.5.2-150 and Table 5C.5.2-151, respectively, and differences between pairs of model scenarios are presented in Table 5C.5.2-152 and Table 5C.5.2-153, respectively. Mean monthly water temperatures during August through December under ESO_ELT and ESO_LLT at both locations would be similar to temperatures under EBC2_ELT and EBC2_LLT, respectively, throughout the period regardless of water-year type. Further, there would be no differences in the high-flow or low-flow channels in mean monthly water temperatures between HOS and LOS scenarios and the ESO during December through June (Table 5C.5.2-154 through Table 5C.5.2-157). These results indicate that ESO, HOS, and LOS scenarios would have no temperature-related effects on fall-run adult migration.

5C.5.2.4.4 Splittail

Because most splittail occur in the Feather River from February through June for spawning, egg incubation, and larval and juvenile rearing, and there is high overlap among all lifestages during this period, this analysis combines all lifestages together. Important distinctions among life stages are discussed where necessary.

As described for the Sacramento River, splittail spawning and rearing of larvae and young juveniles in channel margin and side-channel habitat in the Feather River is likely to be especially important during drier water years, when flows are too low to inundate the floodplains. Splittail have been found upstream in the Feather River almost to the Thermalito Afterbay outlet (Sommer et al. 2007).

Spawning and Rearing Habitat

The side-channel habitats of upstream waterways, including the Feather River, are used by splittail for spawning and rearing (Feyrer et al. 2005). These side channels are affected by changes in flow because: (1) greater flows cause more flooding, thereby increasing availability of such habitat; and (2) rapid reductions in flow dewater the habitats, potentially stranding splittail eggs and rearing larvae. The changes in flows are expected to be especially important in years with low-flows.

Monthly average flows by water-year type were reviewed for the Feather River at the confluence with the Sacramento River during the February through June spawning and larval and juvenile rearing period to investigate the potential effects of BDCP operations on side-channel habitat availability in the mainstem Feather River. Year-round monthly average flows by water-year type for the Feather River at the confluence are presented in Table 5C.5.2-185 and differences between pairs of model scenarios are presented in Table 5C.5.2-186. Year-round monthly exceedance plots are presented in Figure 5C.5.2-123 through Figure 5C.5.2-134 and exceedance plots specific to the February through June spawning and rearing period are presented in Figure 5C.5.2-124 through Figure 5C.5.2-128. Results show that mean flows during February through April under ESO_ELT and ESO_LLT would generally be similar to flows under EBC2_ELT and EBC2_LLT, respectively. Flows under ESO_ELT and ESO_LLT during May and June would generally be greater than flows under EBC2_ELT and EBC2_LLT, respectively, by an average across water-year types of up to 35%. This pattern is consistent in all water years except critical years. In critical water years, flows under ESO_ELT and ESO_LLT would generally be similar to (in the LLT) or slightly lower (in the ELT) than flows under EBC2_ELT and EBC2_LLT, respectively. These results indicate that there would be similar amounts of side channels habitat available for splittail spawning and rearing under the ESO earlier in the period and greater amounts later in the period except in critical years, in which side channel habitat would be slightly lower in the early long-term. Overall, the ESO would provide a net benefit on splittail spawning and rearing habitat in the Feather River.

Year-round monthly average flows by water-year type for the Feather River at the confluence are presented in Table 5C.5.2-187 and differences between pairs of model scenarios are presented in Table 5C.5.2-188. Flows during the February through June spawning and larval and juvenile rearing period under LOS would generally be similar to or greater than flows under ESO. Flows under HOS during February through May would generally be similar to or greater than flows under ESO, but flows under HOS would be up to 30% lower during June (Table 5C.5.2-185). Despite this reduction, June flows under the HOS would be similar to flows under EBC2. Therefore, the reduction would not have biologically meaningful effects on splittail habitat. Overall, due to similarities to ESO flows, HOS and LOS scenarios would provide a net benefit on splittail spawning and rearing habitat in the Feather River.

Table 5C.5.2-185. Mean Monthly Flows (cfs) in the Feather River at the Confluence with the Sacramento River under EBC and ESO Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	23,533	22,926	24,852	26,106	24,851	25,241
	AN	12,430	11,484	11,755	11,953	11,475	11,993
	BN	6,499	5,581	5,658	5,575	5,377	5,556
	D	4,621	4,292	4,390	4,412	4,437	4,510
	C	3,646	3,429	3,551	3,837	3,530	3,921
	All	11,938	11,346	12,049	12,509	11,967	12,271
Feb	W	27,039	26,129	29,508	31,065	29,950	32,560
	AN	14,818	12,840	14,119	14,599	15,877	15,749
	BN	9,153	8,053	8,081	7,892	7,835	8,144
	D	4,402	4,223	4,365	4,436	4,329	4,413
	C	3,237	3,118	3,086	3,096	3,063	3,130
	All	13,744	12,922	14,212	14,761	14,556	15,446
Mar	W	24,172	23,698	25,585	26,784	25,453	26,416
	AN	19,990	19,240	21,173	21,490	21,464	22,379
	BN	8,136	7,237	7,175	6,882	6,893	6,480
	D	5,073	4,794	4,626	4,940	4,792	5,103
	C	2,933	2,620	2,695	2,756	2,895	2,844
	All	13,521	13,001	13,846	14,300	13,864	14,294
Apr	W	15,897	15,955	16,056	15,852	16,081	15,852
	AN	9,832	9,848	9,733	9,585	9,733	9,598
	BN	5,401	5,328	5,232	5,189	5,238	5,722
	D	4,152	4,198	4,233	4,137	4,441	4,705
	C	3,298	3,280	3,195	3,185	3,423	3,418
	All	8,796	8,811	8,805	8,689	8,893	8,941
May	W	14,387	14,390	12,987	10,385	12,984	10,713
	AN	8,068	7,986	7,777	6,884	8,633	7,718
	BN	4,704	4,642	4,534	4,509	4,703	5,541
	D	3,652	3,642	3,660	3,767	3,920	4,106
	C	2,389	2,332	2,492	2,321	2,309	2,282
	All	7,697	7,665	7,198	6,237	7,382	6,708
Jun	W	10,222	10,273	7,790	7,199	9,571	9,407
	AN	6,391	6,454	5,485	5,598	8,206	8,637
	BN	4,495	4,524	4,346	4,342	7,688	7,154
	D	3,853	4,055	3,776	3,367	4,723	3,873
	C	2,782	2,778	2,678	2,522	2,449	2,504
	All	6,197	6,271	5,236	4,951	6,943	6,685
Jul	W	8,177	8,423	8,536	8,734	8,064	7,923
	AN	9,322	9,657	9,442	9,223	9,527	9,107
	BN	9,380	9,492	8,985	8,725	8,613	7,709
	D	8,290	8,241	7,690	7,674	6,164	4,658
	C	6,450	5,878	5,831	4,891	2,927	2,296
	All	8,322	8,374	8,164	8,009	7,203	6,519

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Aug	W	4,923	5,478	6,656	7,222	5,922	5,801
	AN	7,080	7,395	7,790	8,089	7,425	6,652
	BN	7,236	7,365	7,098	7,570	6,628	6,239
	D	7,711	6,760	6,185	5,487	4,425	4,161
	C	2,841	2,849	2,408	2,340	2,922	2,306
	All	5,941	5,977	6,172	6,313	5,495	5,129
Sep	W	4,351	10,549	10,426	10,329	8,688	9,057
	AN	4,194	8,970	9,070	8,773	7,662	7,030
	BN	4,252	4,508	4,896	4,786	3,596	3,501
	D	4,179	3,831	3,281	2,848	2,996	2,991
	C	2,054	2,138	2,052	1,964	2,349	2,296
	All	3,937	6,581	6,490	6,289	5,491	5,490
Oct	W	4,176	3,919	3,741	3,746	3,968	3,795
	AN	2,630	2,999	2,839	2,988	3,052	3,409
	BN	3,754	3,362	3,394	3,437	3,619	3,467
	D	3,033	3,002	3,139	2,987	3,675	3,447
	C	2,938	2,727	2,701	2,566	2,780	3,123
	All	3,446	3,314	3,266	3,243	3,536	3,507
Nov	W	4,697	4,467	4,407	3,825	4,476	3,750
	AN	3,065	3,310	3,220	3,186	3,209	2,982
	BN	2,687	2,668	2,589	2,455	2,573	2,464
	D	2,342	2,253	2,284	2,125	2,362	2,243
	C	2,084	2,118	2,073	2,107	2,127	2,045
	All	3,216	3,161	3,115	2,873	3,158	2,838
Dec	W	12,409	10,699	11,909	10,246	11,629	10,755
	AN	5,193	5,602	6,005	6,000	6,148	5,523
	BN	3,079	3,441	3,342	3,249	3,390	3,181
	D	2,838	2,844	2,787	2,811	2,952	2,800
	C	2,975	2,540	2,152	2,054	2,399	2,973
	All	6,279	5,796	6,152	5,599	6,165	5,811

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of scenarios.

Table 5C.5.2-186. Differences[a] between EBC and ESO Scenarios in Mean Monthly Flows in the Feather River at the Confluence with the Sacramento River

Month	Water-Year Type[b]	Scenarios[c] EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	1318 (5.6%)	1708 (7.3%)	1925 (8.4%)	2315 (10.1%)	-1 (-0.004%)	-865 (-3.3%)
	AN	-955 (-7.7%)	-437 (-3.5%)	-9 (-0.1%)	509 (4.4%)	-280 (-2.4%)	40 (0.3%)
	BN	-1122 (-17.3%)	-944 (-14.5%)	-204 (-3.7%)	-26 (-0.5%)	-281 (-5%)	-20 (-0.4%)
	D	-184 (-4%)	-111 (-2.4%)	145 (3.4%)	219 (5.1%)	47 (1.1%)	98 (2.2%)
	C	-117 (-3.2%)	275 (7.5%)	101 (2.9%)	493 (14.4%)	-22 (-0.6%)	85 (2.2%)
	All	29 (0.2%)	332 (2.8%)	621 (5.5%)	924 (8.1%)	-82 (-0.7%)	-238 (-1.9%)
Feb	W	2911 (10.8%)	5521 (20.4%)	3821 (14.6%)	6431 (24.6%)	442 (1.5%)	1495 (4.8%)
	AN	1058 (7.1%)	930 (6.3%)	3037 (23.7%)	2909 (22.7%)	1758 (12.4%)	1149 (7.9%)
	BN	-1318 (-14.4%)	-1009 (-11%)	-218 (-2.7%)	90 (1.1%)	-246 (-3%)	251 (3.2%)
	D	-73 (-1.7%)	11 (0.3%)	106 (2.5%)	190 (4.5%)	-36 (-0.8%)	-23 (-0.5%)
	C	-174 (-5.4%)	-107 (-3.3%)	-54 (-1.7%)	12 (0.4%)	-23 (-0.7%)	34 (1.1%)
	All	812 (5.9%)	1701 (12.4%)	1634 (12.6%)	2524 (19.5%)	344 (2.4%)	685 (4.6%)
Mar	W	1281 (5.3%)	2245 (9.3%)	1756 (7.4%)	2719 (11.5%)	-132 (-0.5%)	-367 (-1.4%)
	AN	1474 (7.4%)	2389 (12%)	2224 (11.6%)	3139 (16.3%)	291 (1.4%)	890 (4.1%)
	BN	-1243 (-15.3%)	-1656 (-20.4%)	-343 (-4.7%)	-757 (-10.5%)	-282 (-3.9%)	-402 (-5.8%)
	D	-281 (-5.5%)	30 (0.6%)	-2 (0%)	309 (6.4%)	165 (3.6%)	163 (3.3%)
	C	-37 (-1.3%)	-88 (-3%)	275 (10.5%)	224 (8.6%)	200 (7.4%)	88 (3.2%)
	All	343 (2.5%)	772 (5.7%)	863 (6.6%)	1293 (9.9%)	18 (0.1%)	-6 (-0.04%)
Apr	W	184 (1.2%)	-45 (-0.3%)	127 (0.8%)	-102 (-0.6%)	25 (0.2%)	1 (0004%)
	AN	-99 (-1%)	-234 (-2.4%)	-116 (-1.2%)	-250 (-2.5%)	0 (0%)	13 (0.1%)
	BN	-162 (-3%)	321 (5.9%)	-89 (-1.7%)	394 (7.4%)	7 (0.1%)	533 (10.3%)
	D	289 (7%)	554 (13.3%)	243 (5.8%)	507 (12.1%)	208 (4.9%)	569 (13.7%)
	C	125 (3.8%)	120 (3.6%)	143 (4.4%)	138 (4.2%)	228 (7.1%)	233 (7.3%)
	All	98 (1.1%)	145 (1.7%)	82 (0.9%)	130 (1.5%)	88 (1%)	252 (2.9%)
May	W	-1403 (-9.7%)	-3674 (-25.5%)	-1406 (-9.8%)	-3677 (-25.6%)	-3 (0%)	328 (3.2%)
	AN	565 (7%)	-350 (-4.3%)	647 (8.1%)	-268 (-3.4%)	856 (11%)	835 (12.1%)
	BN	-1 (0%)	837 (17.8%)	61 (1.3%)	900 (19.4%)	169 (3.7%)	1033 (22.9%)
	D	268 (7.3%)	454 (12.4%)	278 (7.6%)	464 (12.7%)	260 (7.1%)	338 (9%)
	C	-79 (-3.3%)	-106 (-4.5%)	-22 (-1%)	-49 (-2.1%)	-182 (-7.3%)	-39 (-1.7%)
	All	-315 (-4.1%)	-989 (-12.9%)	-283 (-3.7%)	-957 (-12.5%)	184 (2.6%)	471 (7.6%)
Jun	W	-651 (-6.4%)	-815 (-8%)	-702 (-6.8%)	-865 (-8.4%)	1781 (22.9%)	2208 (30.7%)
	AN	1815 (28.4%)	2246 (35.1%)	1752 (27.1%)	2183 (33.8%)	2721 (49.6%)	3040 (54.3%)
	BN	3192 (71%)	2659 (59.1%)	3164 (69.9%)	2630 (58.1%)	3341 (76.9%)	2812 (64.8%)
	D	870 (22.6%)	20 (0.5%)	667 (16.5%)	-183 (-4.5%)	946 (25.1%)	506 (15%)
	C	-333 (-12%)	-278 (-10%)	-329 (-11.8%)	-274 (-9.9%)	-229 (-8.5%)	-18 (-0.7%)
	All	746 (12%)	488 (7.9%)	672 (10.7%)	414 (6.6%)	1708 (32.6%)	1734 (35%)
Jul	W	-113 (-1.4%)	-254 (-3.1%)	-359 (-4.3%)	-500 (-5.9%)	-473 (-5.5%)	-812 (-9.3%)
	AN	205 (2.2%)	-216 (-2.3%)	-130 (-1.3%)	-551 (-5.7%)	85 (0.9%)	-116 (-1.3%)
	BN	-767 (-8.2%)	-1672 (-17.8%)	-879 (-9.3%)	-1783 (-18.8%)	-372 (-4.1%)	-1016 (-11.6%)
	D	-2126 (-25.6%)	-3632 (-43.8%)	-2077 (-25.2%)	-3583 (-43.5%)	-1527 (-19.9%)	-3016 (-39.3%)
	C	-3524 (-54.6%)	-4154 (-64.4%)	-2951 (-50.2%)	-3582 (-60.9%)	-2905 (-49.8%)	-2595 (-53.1%)
	All	-1119 (-13.4%)	-1803 (-21.7%)	-1171 (-14%)	-1854 (-22.1%)	-961 (-11.8%)	-1490 (-18.6%)

Month	Water-Year Type[b]	Scenarios[c] EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Aug	W	998 (20.3%)	878 (17.8%)	444 (8.1%)	323 (5.9%)	-735 (-11%)	-1421 (-19.7%)
	AN	345 (4.9%)	-428 (-6%)	30 (0.4%)	-743 (-10%)	-365 (-4.7%)	-1437 (-17.8%)
	BN	-608 (-8.4%)	-996 (-13.8%)	-737 (-10%)	-1125 (-15.3%)	-470 (-6.6%)	-1330 (-17.6%)
	D	-3286 (-42.6%)	-3550 (-46%)	-2334 (-34.5%)	-2599 (-38.4%)	-1759 (-28.4%)	-1326 (-24.2%)
	C	81 (2.9%)	-534 (-18.8%)	72 (2.5%)	-543 (-19.1%)	514 (21.4%)	-34 (-1.4%)
	All	-446 (-7.5%)	-812 (-13.7%)	-483 (-8.1%)	-848 (-14.2%)	-678 (-11%)	-1184 (-18.8%)
Sep	W	4337 (99.7%)	4705 (108.1%)	-1860 (-17.6%)	-1492 (-14.1%)	-1738 (-16.7%)	-1273 (-12.3%)
	AN	3468 (82.7%)	2835 (67.6%)	-1308 (-14.6%)	-1941 (-21.6%)	-1408 (-15.5%)	-1744 (-19.9%)
	BN	-656 (-15.4%)	-751 (-17.7%)	-912 (-20.2%)	-1007 (-22.3%)	-1301 (-26.6%)	-1285 (-26.9%)
	D	-1183 (-28.3%)	-1188 (-28.4%)	-836 (-21.8%)	-841 (-21.9%)	-286 (-8.7%)	143 (5%)
	C	295 (14.4%)	242 (11.8%)	211 (9.9%)	158 (7.4%)	297 (14.5%)	332 (16.9%)
	All	1554 (39.5%)	1553 (39.4%)	-1090 (-16.6%)	-1090 (-16.6%)	-998 (-15.4%)	-798 (-12.7%)
Oct	W	-208 (-5%)	-381 (-9.1%)	49 (1.2%)	-125 (-3.2%)	227 (6.1%)	49 (1.3%)
	AN	421 (16%)	779 (29.6%)	53 (1.8%)	410 (13.7%)	212 (7.5%)	421 (14.1%)
	BN	-135 (-3.6%)	-287 (-7.6%)	257 (7.7%)	105 (3.1%)	225 (6.6%)	29 (0.9%)
	D	643 (21.2%)	414 (13.6%)	673 (22.4%)	444 (14.8%)	536 (17.1%)	460 (15.4%)
	C	-158 (-5.4%)	184 (6.3%)	53 (1.9%)	395 (14.5%)	79 (2.9%)	557 (21.7%)
	All	91 (2.6%)	62 (1.8%)	223 (6.7%)	194 (5.8%)	271 (8.3%)	265 (8.2%)
Nov	W	-221 (-4.7%)	-946 (-20.2%)	10 (0.2%)	-716 (-16%)	69 (1.6%)	-75 (-2%)
	AN	145 (4.7%)	-83 (-2.7%)	-101 (-3.1%)	-329 (-9.9%)	-11 (-0.3%)	-205 (-6.4%)
	BN	-115 (-4.3%)	-223 (-8.3%)	-96 (-3.6%)	-204 (-7.6%)	-17 (-0.6%)	10 (0.4%)
	D	19 (0.8%)	-99 (-4.2%)	109 (4.8%)	-10 (-0.4%)	78 (3.4%)	118 (5.6%)
	C	43 (2%)	-40 (-1.9%)	9 (0.4%)	-73 (-3.4%)	54 (2.6%)	-62 (-3%)
	All	-58 (-1.8%)	-378 (-11.8%)	-3 (-0.1%)	-323 (-10.2%)	42 (1.4%)	-35 (-1.2%)
Dec	W	-780 (-6.3%)	-1654 (-13.3%)	931 (8.7%)	57 (0.5%)	-279 (-2.3%)	509 (5%)
	AN	955 (18.4%)	329 (6.3%)	547 (9.8%)	-79 (-1.4%)	143 (2.4%)	-477 (-8%)
	BN	310 (10.1%)	102 (3.3%)	-52 (-1.5%)	-260 (-7.6%)	48 (1.4%)	-68 (-2.1%)
	D	114 (4%)	-37 (-1.3%)	107 (3.8%)	-44 (-1.5%)	164 (5.9%)	-11 (-0.4%)
	C	-577 (-19.4%)	-2 (-0.1%)	-141 (-5.6%)	433 (17%)	246 (11.4%)	918 (44.7%)
	All	-114 (-1.8%)	-467 (-7.4%)	369 (6.4%)	16 (0.3%)	13 (0.2%)	212 (3.8%)

[a] Positive values indicate greater flows under ESO than under EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of scenarios.

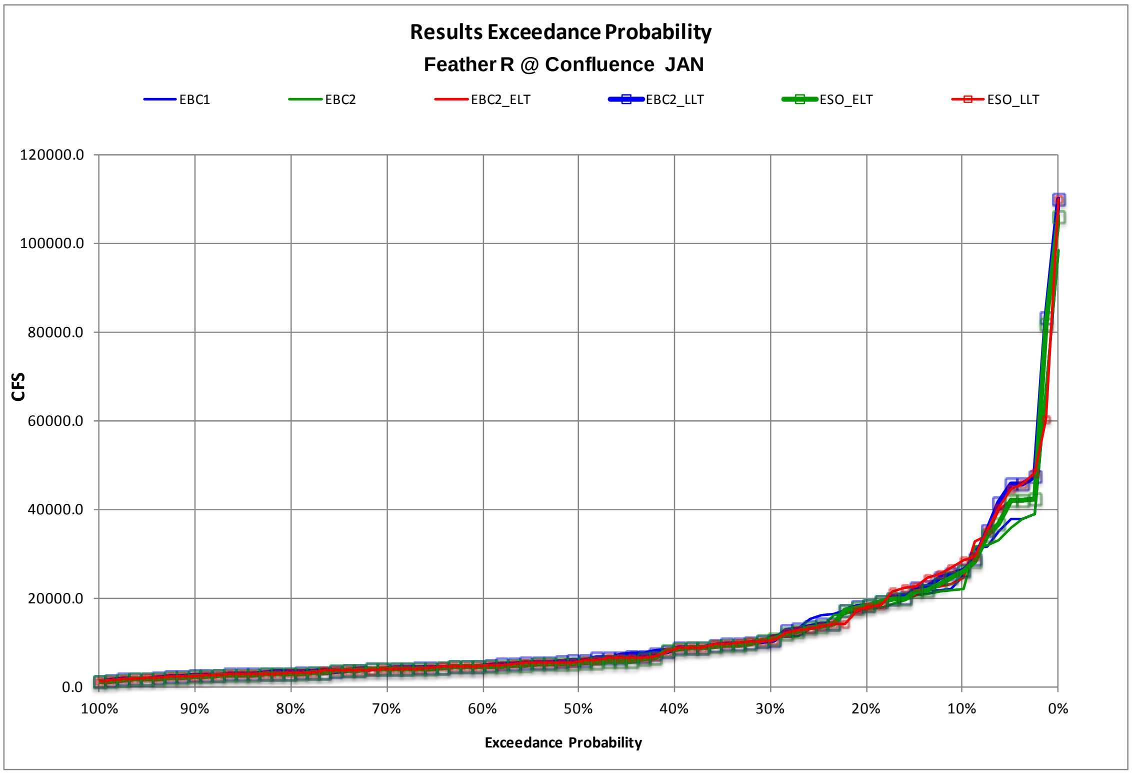


Figure 5C.5.2-123. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River at the Confluence with the Sacramento River, January

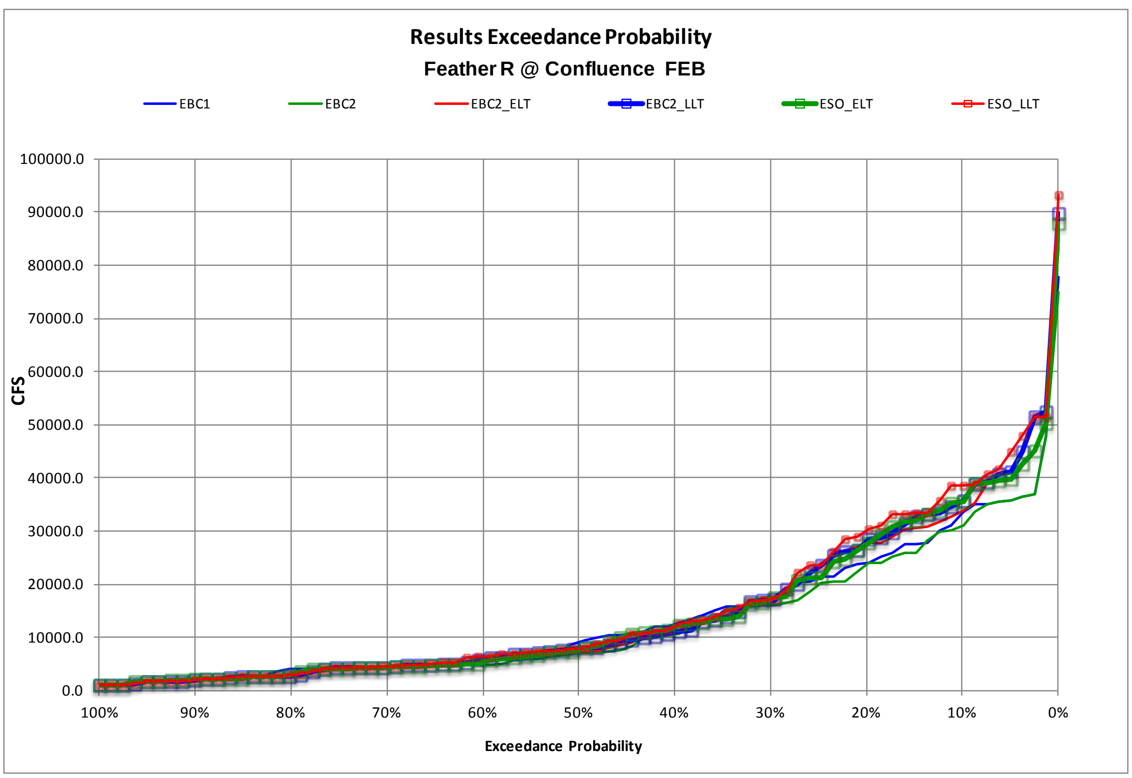


Figure 5C.5.2-124. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River at the Confluence with the Sacramento River, February

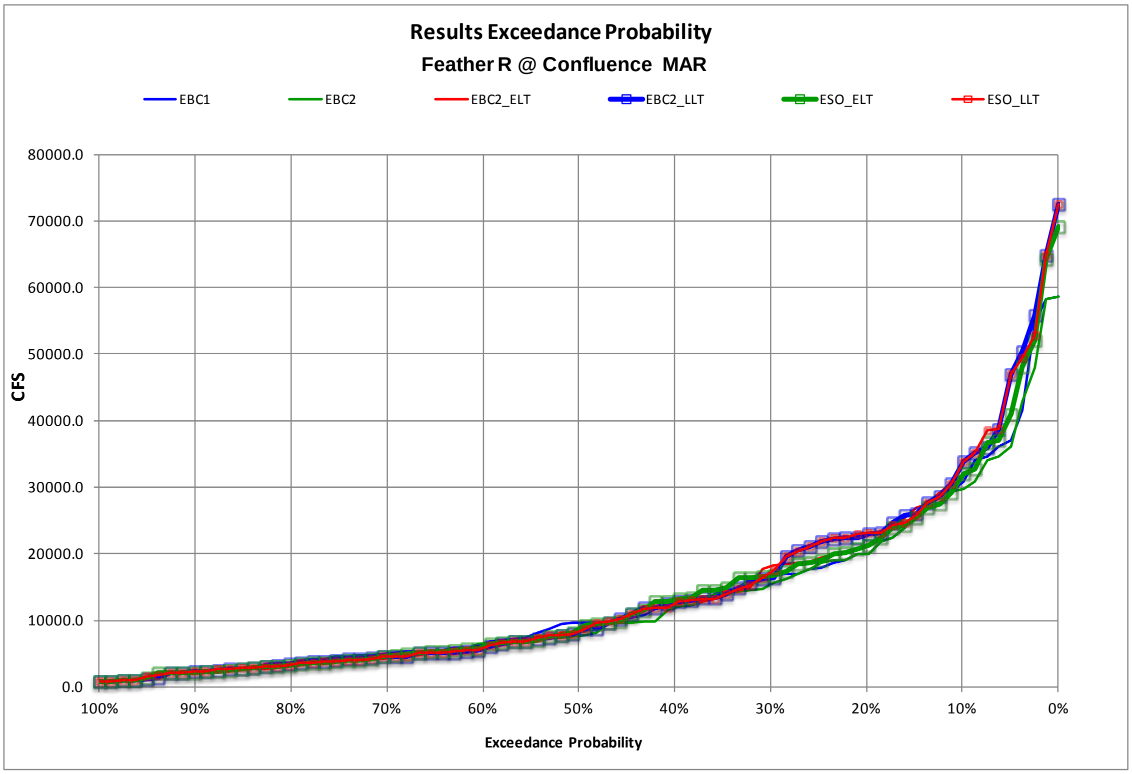


Figure 5C.5.2-125. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River at the Confluence with the Sacramento River, March

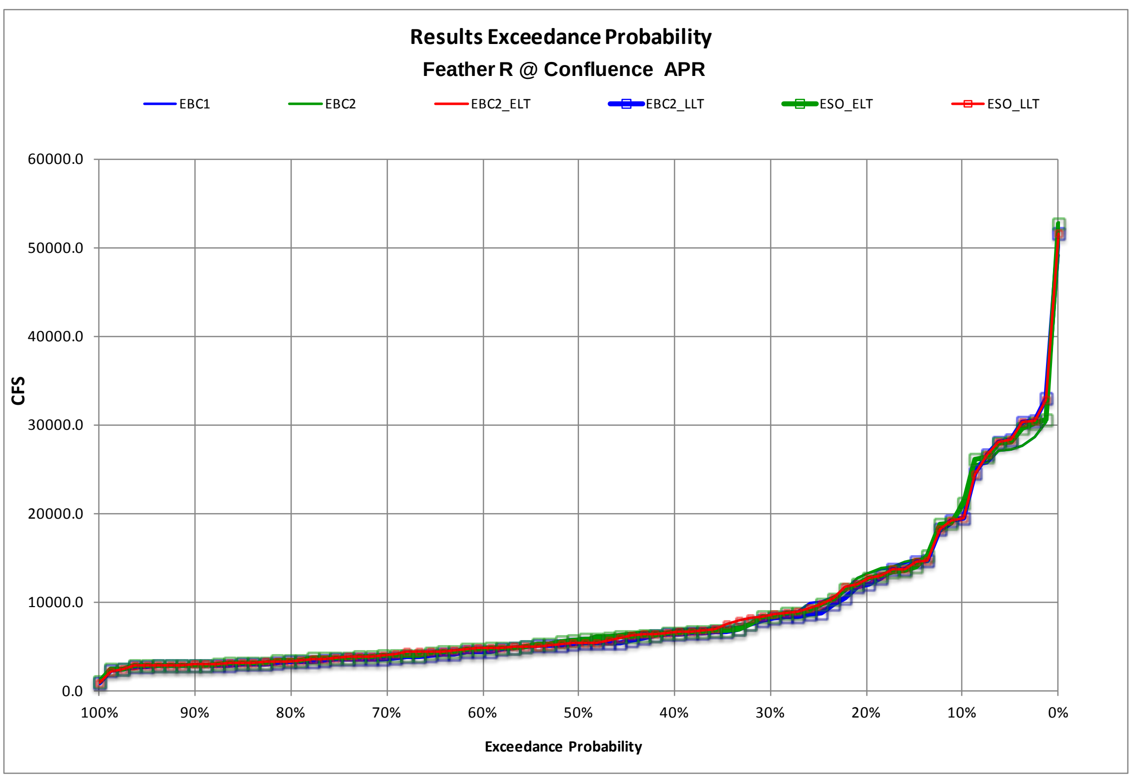


Figure 5C.5.2-126. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River at the Confluence with the Sacramento River, April

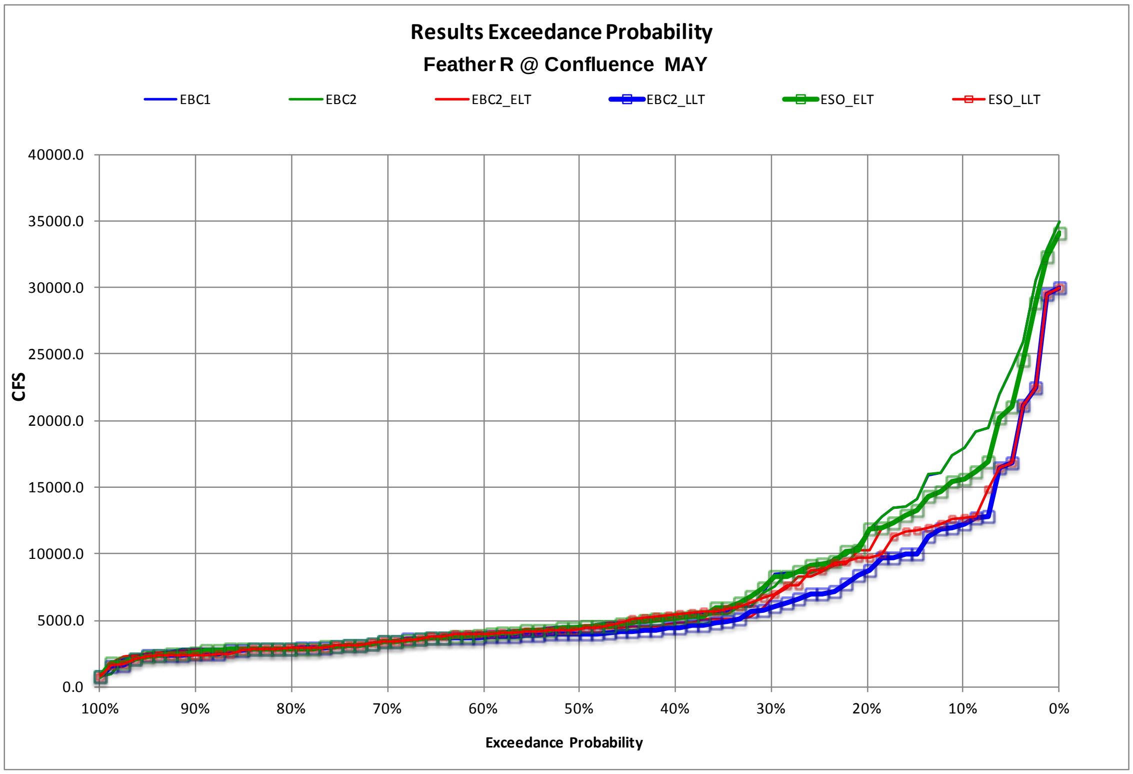


Figure 5C.5.2-127. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River at the Confluence with the Sacramento River, May

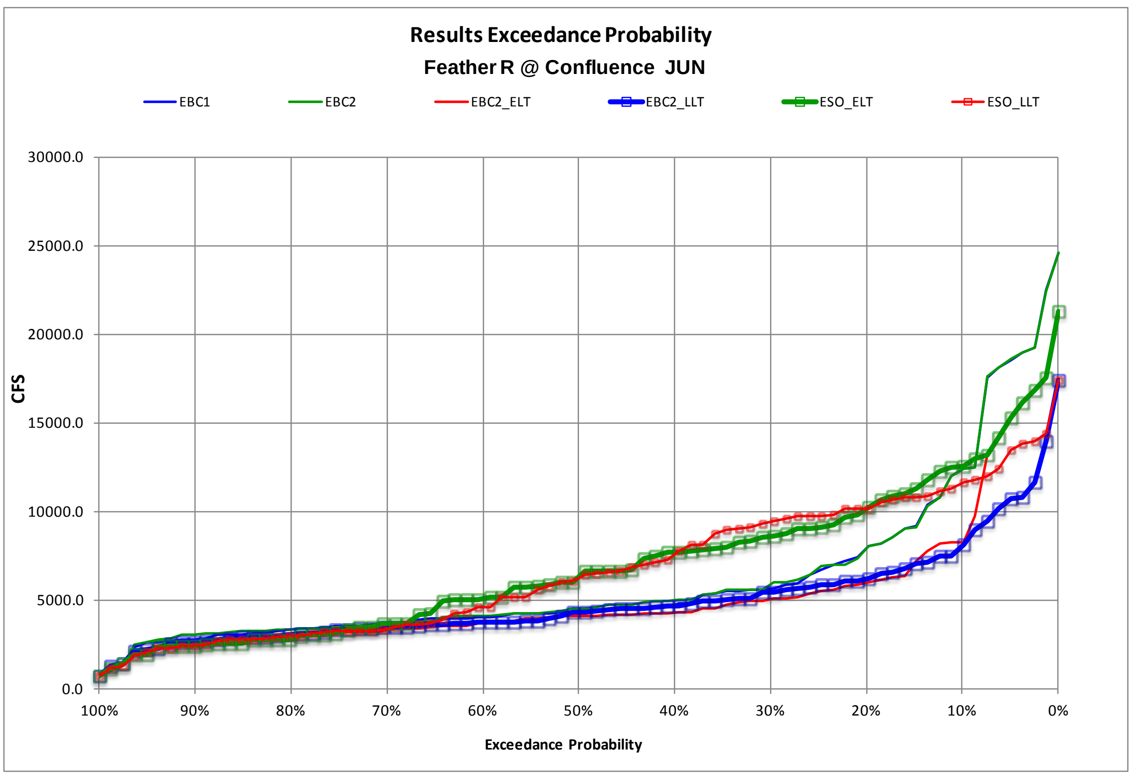


Figure 5C.5.2-128. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River at the Confluence with the Sacramento River, June

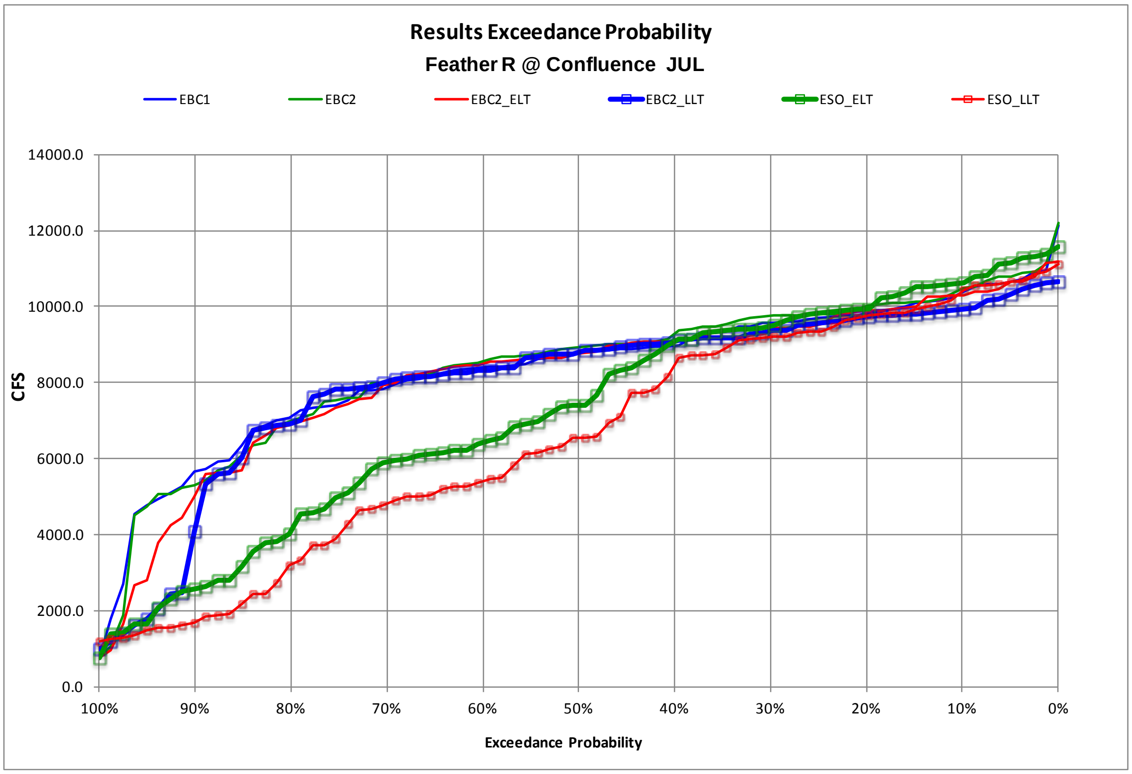


Figure 5C.5.2-129. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River at the Confluence with the Sacramento River, July

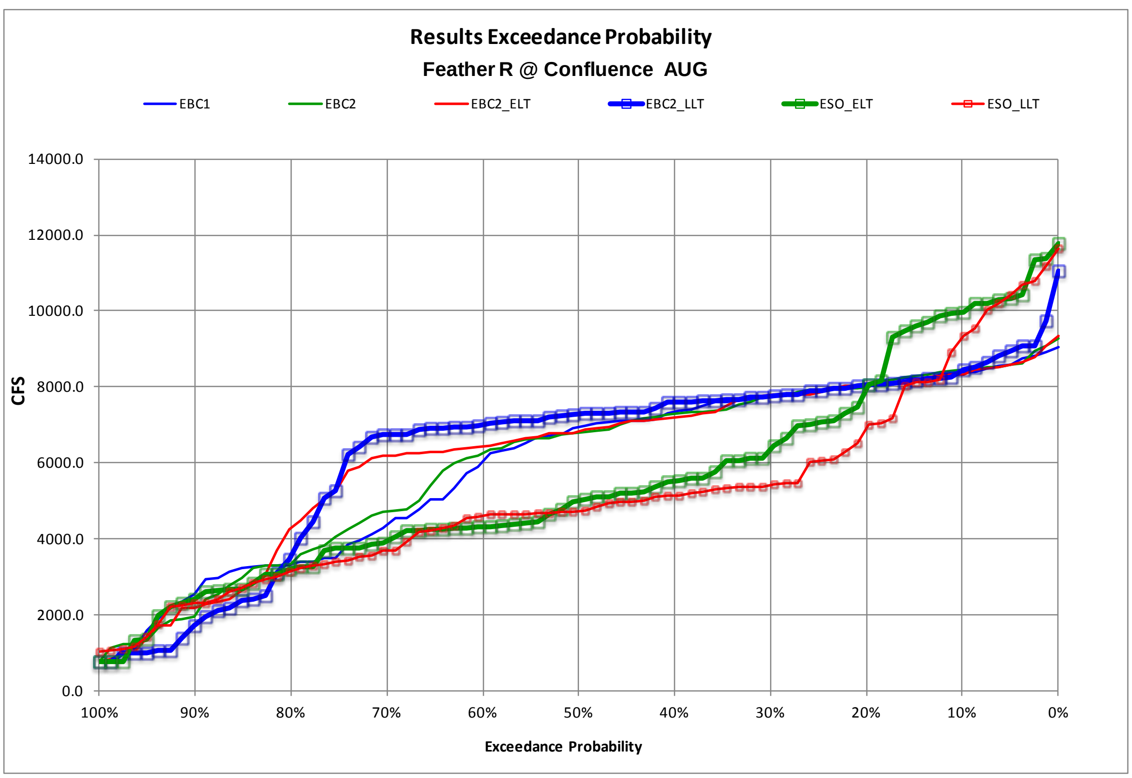


Figure 5C.5.2-130. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River at the Confluence with the Sacramento River, August

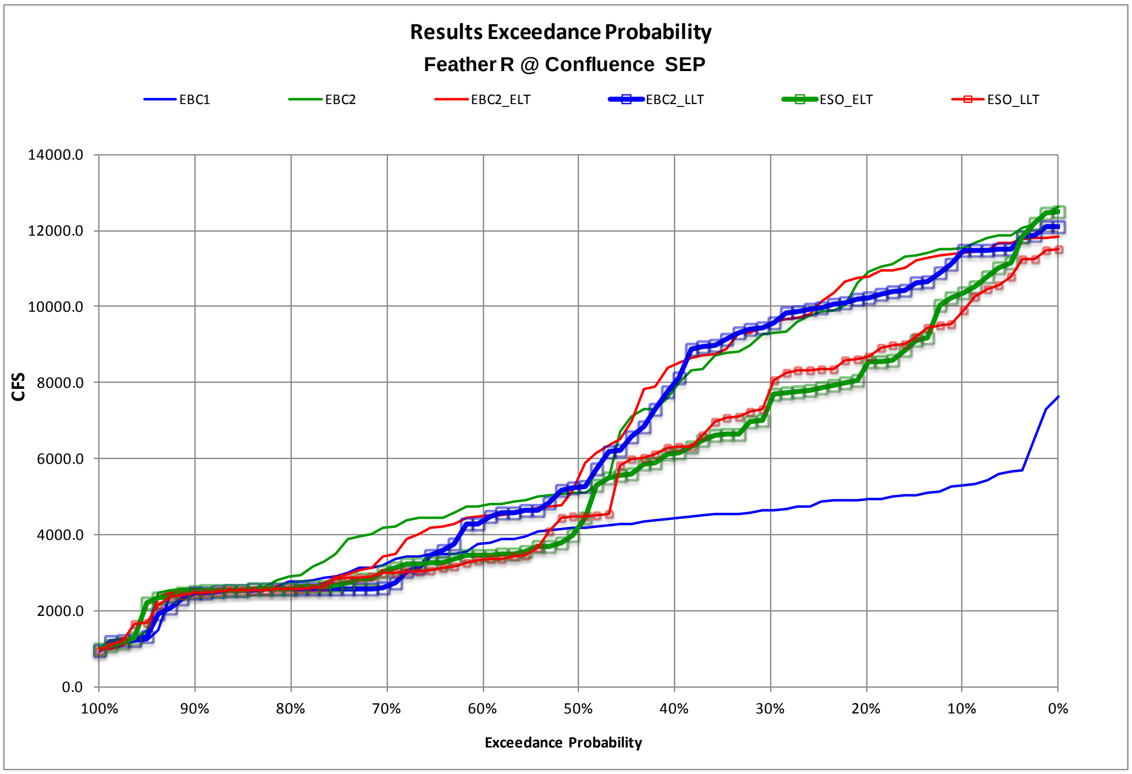


Figure 5C.5.2-131. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River at the Confluence with the Sacramento River, September

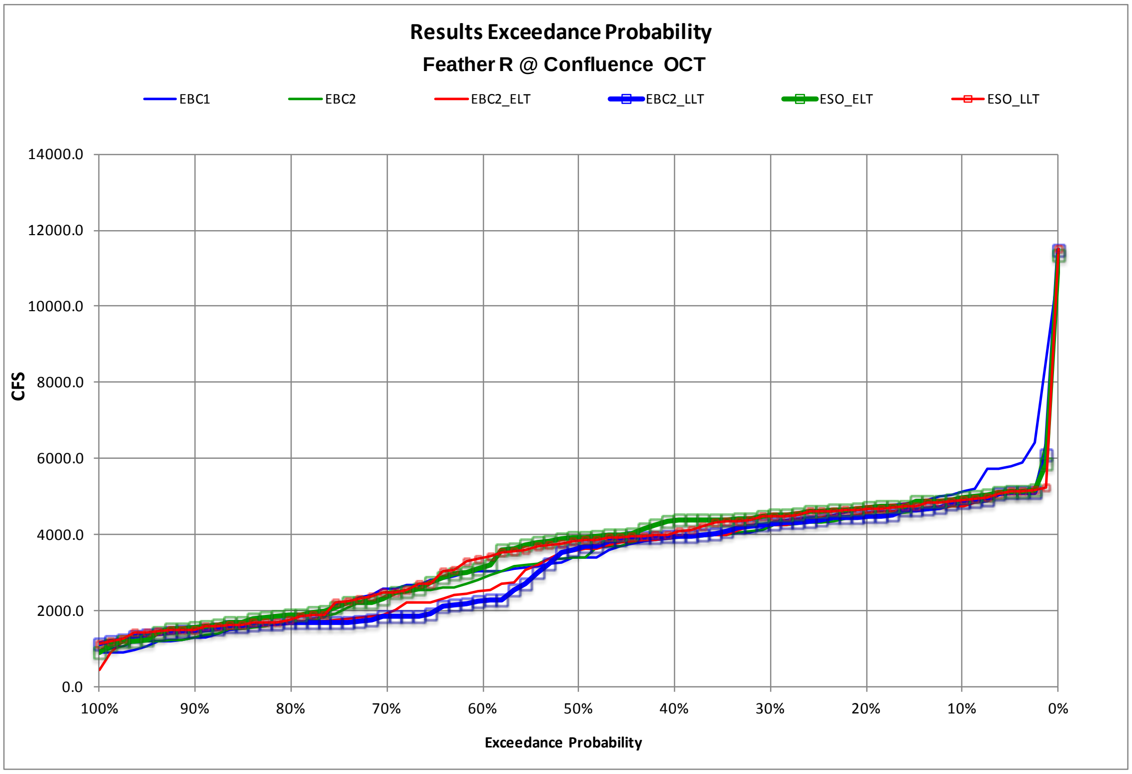


Figure 5C.5.2-132. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River at the Confluence with the Sacramento River, October

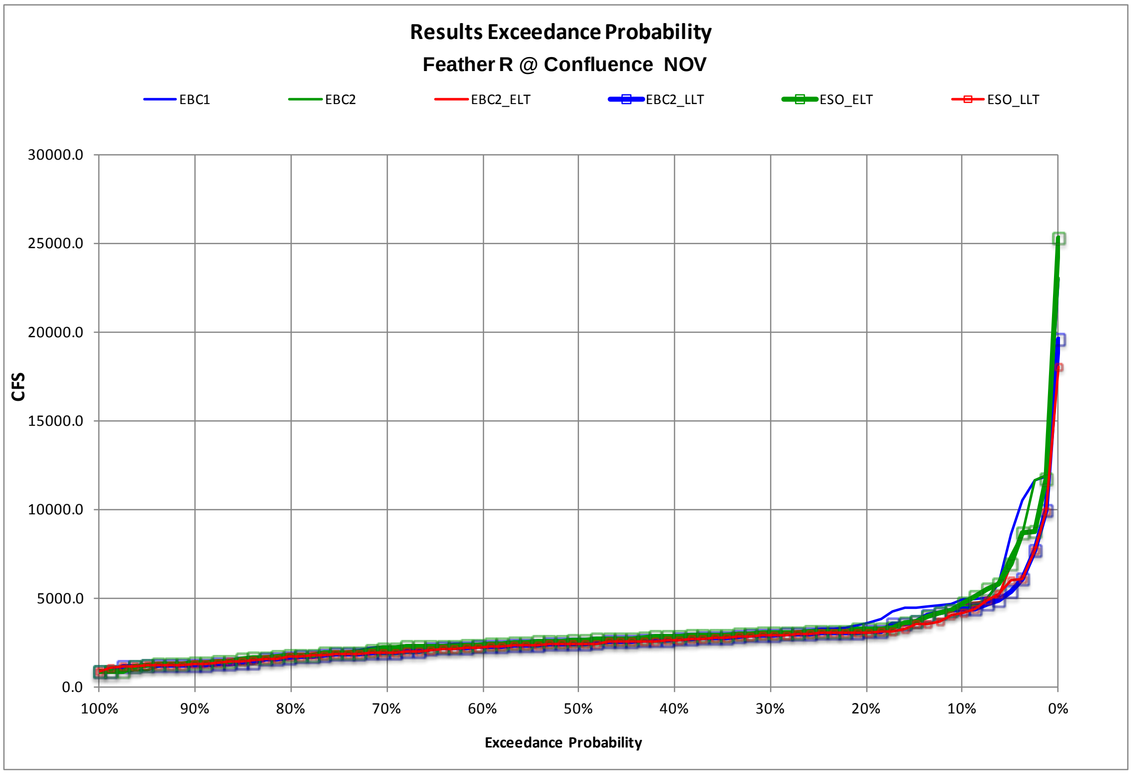


Figure 5C.5.2-133. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River at the Confluence with the Sacramento River, November

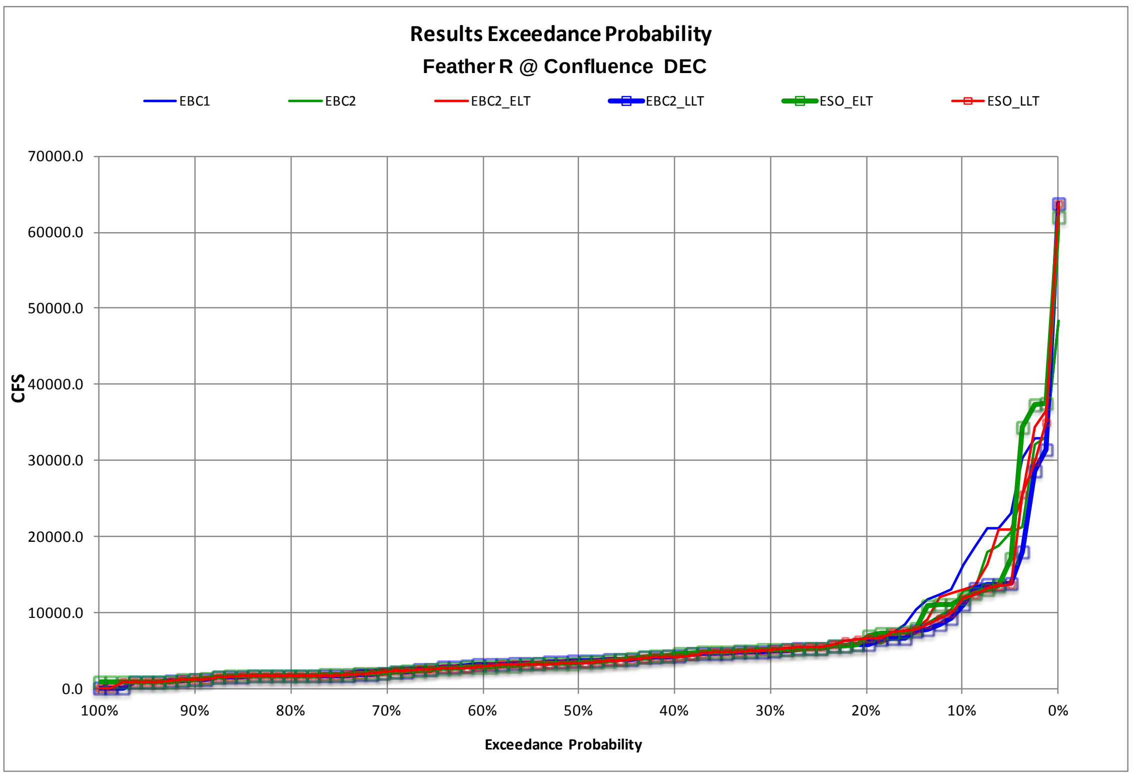


Figure 5C.5.2-134. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Feather River at the Confluence with the Sacramento River, December

Table 5C.5.2-187. Mean Monthly Flows (cfs) in the Feather River at the Confluence with the Sacramento River for ESO, HOS, and LOS Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	24,851	25,241	25,262	26,310	26,147	27,778
	AN	11,475	11,993	12,431	12,810	12,039	12,792
	BN	5,377	5,556	5,655	5,737	5,655	5,522
	D	4,437	4,510	4,364	4,471	4,546	4,768
	C	3,530	3,921	3,486	3,806	4,535	3,875
	All	11,967	12,271	12,263	12,735	12,679	13,236
Feb	W	29,950	32,560	29,179	31,504	29,895	32,444
	AN	15,877	15,749	14,875	16,347	16,770	16,400
	BN	7,835	8,144	8,999	8,755	8,905	8,764
	D	4,329	4,413	4,301	4,328	4,325	4,453
	C	3,063	3,130	3,110	3,113	3,107	3,019
	All	14,556	15,446	14,364	15,282	14,857	15,603
Mar	W	25,453	26,416	25,455	26,811	25,796	26,873
	AN	21,464	22,379	21,540	21,385	21,925	23,191
	BN	6,893	6,480	7,507	7,024	7,360	6,970
	D	4,792	5,103	4,898	4,962	4,928	5,127
	C	2,895	2,844	2,927	2,938	2,837	2,907
	All	13,864	14,294	14,008	14,349	14,141	14,655
Apr	W	16,081	15,852	19,335	19,220	16,057	15,853
	AN	9,733	9,598	13,422	13,420	9,732	9,696
	BN	5,238	5,722	11,437	11,424	5,369	5,755
	D	4,441	4,705	4,656	4,766	4,383	4,805
	C	3,423	3,418	3,263	3,258	3,470	3,514
	All	8,893	8,941	11,547	11,531	8,902	8,997
May	W	12,984	10,713	15,985	13,542	12,986	10,676
	AN	8,633	7,718	11,549	9,747	8,271	7,704
	BN	4,703	5,541	7,182	6,312	4,696	5,290
	D	3,920	4,106	4,134	4,188	3,868	4,182
	C	2,309	2,282	2,355	2,306	2,359	2,310
	All	7,382	6,708	9,237	8,055	7,324	6,672
Jun	W	9,571	9,407	7,327	6,899	9,601	9,022
	AN	8,206	8,637	6,150	6,120	8,210	8,594
	BN	7,688	7,154	5,436	5,537	8,202	7,095
	D	4,723	3,873	3,911	3,401	4,960	3,959
	C	2,449	2,504	2,389	2,350	2,558	2,423
	All	6,943	6,685	5,360	5,119	7,109	6,553
Jul	W	8,064	7,923	6,655	6,446	8,006	7,694
	AN	9,527	9,107	6,338	5,560	9,467	8,922
	BN	8,613	7,709	7,222	6,380	8,263	7,631
	D	6,164	4,658	5,169	4,231	6,738	5,101
	C	2,927	2,296	3,523	2,851	2,955	2,573
	All	7,203	6,519	5,921	5,293	7,246	6,544

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Aug	W	5,922	5,801	3,897	4,116	5,676	5,763
	AN	7,425	6,652	4,720	4,739	7,515	6,629
	BN	6,628	6,239	5,303	4,625	6,998	6,442
	D	4,425	4,161	3,765	3,560	4,842	4,704
	C	2,922	2,306	3,407	2,841	2,879	2,214
	All	5,495	5,129	4,157	3,985	5,579	5,254
Sep	W	8,688	9,057	8,120	8,469	3,359	3,212
	AN	7,662	7,030	6,022	5,989	4,663	4,207
	BN	3,596	3,501	3,031	2,970	3,481	3,418
	D	2,996	2,991	3,037	3,269	3,272	3,465
	C	2,349	2,296	2,750	2,994	2,123	2,485
	All	5,491	5,490	5,043	5,225	3,371	3,342
Oct	W	3,968	3,795	3,490	3,486	4,077	3,967
	AN	3,052	3,409	2,879	3,162	3,403	3,543
	BN	3,619	3,467	3,363	3,562	3,421	3,535
	D	3,675	3,447	2,872	2,628	3,523	3,320
	C	2,780	3,123	2,940	3,638	3,137	3,357
	All	3,536	3,507	3,163	3,286	3,607	3,600
Nov	W	4,476	3,750	4,344	3,848	4,277	4,121
	AN	3,209	2,982	3,039	2,956	3,104	2,949
	BN	2,573	2,464	2,431	2,447	2,488	2,424
	D	2,362	2,243	2,176	2,141	2,289	2,254
	C	2,127	2,045	2,267	2,264	2,290	2,038
	All	3,158	2,838	3,046	2,872	3,073	2,945
Dec	W	11,629	10,755	12,819	11,520	13,250	11,590
	AN	6,148	5,523	6,164	5,673	6,155	6,021
	BN	3,390	3,181	3,217	3,097	3,244	3,768
	D	2,952	2,800	2,757	2,669	2,808	2,644
	C	2,399	2,973	2,197	2,332	2,678	2,991
	All	6,165	5,811	6,443	5,939	6,664	6,217

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of scenarios.

Table 5C.5.2-188. Differences[a] between the ESO Scenarios and HOS and LOS Scenarios in Mean Monthly Flows (cfs) in the Feather River at the Confluence with the Sacramento River

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	411 (1.7%)	1069 (4.2%)	1297 (5.2%)	2537 (10.1%)
	AN	956 (8.3%)	817 (6.8%)	564 (4.9%)	799 (6.7%)
	BN	278 (5.2%)	181 (3.3%)	277 (5.2%)	-34 (-0.6%)
	D	-73 (-1.6%)	-39 (-0.9%)	109 (2.5%)	258 (5.7%)
	C	-44 (-1.2%)	-115 (-2.9%)	1005 (28.5%)	-46 (-1.2%)
	All	295 (2.5%)	464 (3.8%)	712 (5.9%)	965 (7.9%)
Feb	W	-772 (-2.6%)	-1056 (-3.2%)	-56 (-0.2%)	-116 (-0.4%)
	AN	-1002 (-6.3%)	598 (3.8%)	893 (5.6%)	652 (4.1%)
	BN	1164 (14.9%)	611 (7.5%)	1070 (13.7%)	620 (7.6%)
	D	-28 (-0.6%)	-85 (-1.9%)	-4 (-0.1%)	40 (0.9%)
	C	46 (1.5%)	-17 (-0.6%)	43 (1.4%)	-112 (-3.6%)
	All	-192 (-1.3%)	-164 (-1.1%)	301 (2.1%)	157 (1%)
Mar	W	2 (0%)	394 (1.5%)	343 (1.3%)	456 (1.7%)
	AN	76 (0.4%)	-994 (-4.4%)	461 (2.1%)	812 (3.6%)
	BN	613 (8.9%)	543 (8.4%)	467 (6.8%)	490 (7.6%)
	D	107 (2.2%)	-141 (-2.8%)	136 (2.8%)	24 (0.5%)
	C	31 (1.1%)	94 (3.3%)	-58 (-2%)	62 (2.2%)
	All	144 (1%)	55 (0.4%)	277 (2%)	362 (2.5%)
Apr	W	3254 (20.2%)	3367 (21.2%)	-24 (-0.2%)	0 (0%)
	AN	3689 (37.9%)	3822 (39.8%)	-1 (0%)	98 (1%)
	BN	6199 (118.3%)	5702 (99.7%)	131 (2.5%)	33 (0.6%)
	D	215 (4.9%)	61 (1.3%)	-58 (-1.3%)	100 (2.1%)
	C	-160 (-4.7%)	-160 (-4.7%)	47 (1.4%)	96 (2.8%)
	All	2654 (29.8%)	2590 (29%)	9 (0.1%)	56 (0.6%)
May	W	3001 (23.1%)	2829 (26.4%)	2 (0%)	-36 (-0.3%)
	AN	2916 (33.8%)	2029 (26.3%)	-362 (-4.2%)	-14 (-0.2%)
	BN	2479 (52.7%)	771 (13.9%)	-7 (-0.1%)	-252 (-4.5%)
	D	214 (5.4%)	83 (2%)	-52 (-1.3%)	76 (1.9%)
	C	46 (2%)	24 (1.1%)	50 (2.2%)	28 (1.2%)
	All	1855 (25.1%)	1347 (20.1%)	-58 (-0.8%)	-36 (-0.5%)
Jun	W	-2243 (-23.4%)	-2508 (-26.7%)	30 (0.3%)	-385 (-4.1%)
	AN	-2057 (-25.1%)	-2517 (-29.1%)	4 (0.1%)	-43 (-0.5%)
	BN	-2251 (-29.3%)	-1617 (-22.6%)	515 (6.7%)	-59 (-0.8%)
	D	-812 (-17.2%)	-472 (-12.2%)	238 (5%)	86 (2.2%)
	C	-60 (-2.4%)	-154 (-6.2%)	109 (4.5%)	-81 (-3.2%)
	All	-1584 (-22.8%)	-1566 (-23.4%)	166 (2.4%)	-131 (-2%)
Jul	W	-1409 (-17.5%)	-1476 (-18.6%)	-58 (-0.7%)	-229 (-2.9%)
	AN	-3189 (-33.5%)	-3547 (-39%)	-60 (-0.6%)	-184 (-2%)
	BN	-1391 (-16.2%)	-1329 (-17.2%)	-350 (-4.1%)	-77 (-1%)
	D	-995 (-16.1%)	-427 (-9.2%)	575 (9.3%)	443 (9.5%)
	C	596 (20.4%)	555 (24.2%)	28 (1%)	276 (12%)
	All	-1282 (-17.8%)	-1227 (-18.8%)	43 (0.6%)	25 (0.4%)

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	-2025 (-34.2%)	-1685 (-29.1%)	-245 (-4.1%)	-37 (-0.6%)
	AN	-2705 (-36.4%)	-1913 (-28.8%)	90 (1.2%)	-23 (-0.3%)
	BN	-1325 (-20%)	-1615 (-25.9%)	370 (5.6%)	202 (3.2%)
	D	-660 (-14.9%)	-602 (-14.5%)	417 (9.4%)	543 (13%)
	C	485 (16.6%)	535 (23.2%)	-43 (-1.5%)	-92 (-4%)
	All	-1338 (-24.4%)	-1144 (-22.3%)	84 (1.5%)	125 (2.4%)
Sep	W	-569 (-6.5%)	-588 (-6.5%)	-5329 (-61.3%)	-5844 (-64.5%)
	AN	-1640 (-21.4%)	-1041 (-14.8%)	-2999 (-39.1%)	-2823 (-40.2%)
	BN	-564 (-15.7%)	-531 (-15.2%)	-115 (-3.2%)	-82 (-2.4%)
	D	42 (1.4%)	279 (9.3%)	276 (9.2%)	475 (15.9%)
	C	401 (17.1%)	698 (30.4%)	-226 (-9.6%)	188 (8.2%)
	All	-449 (-8.2%)	-266 (-4.8%)	-2121 (-38.6%)	-2149 (-39.1%)
Oct	W	-477 (-12%)	-308 (-8.1%)	109 (2.8%)	172 (4.5%)
	AN	-172 (-5.6%)	-247 (-7.2%)	351 (11.5%)	134 (3.9%)
	BN	-256 (-7.1%)	95 (2.7%)	-198 (-5.5%)	68 (2%)
	D	-804 (-21.9%)	-818 (-23.7%)	-153 (-4.2%)	-126 (-3.7%)
	C	160 (5.7%)	516 (16.5%)	357 (12.8%)	235 (7.5%)
	All	-373 (-10.6%)	-222 (-6.3%)	71 (2%)	93 (2.6%)
Nov	W	-133 (-3%)	98 (2.6%)	-199 (-4.4%)	371 (9.9%)
	AN	-171 (-5.3%)	-25 (-0.8%)	-105 (-3.3%)	-33 (-1.1%)
	BN	-142 (-5.5%)	-18 (-0.7%)	-85 (-3.3%)	-41 (-1.6%)
	D	-186 (-7.9%)	-102 (-4.6%)	-73 (-3.1%)	10 (0.5%)
	C	140 (6.6%)	220 (10.7%)	163 (7.7%)	-7 (-0.3%)
	All	-112 (-3.5%)	34 (1.2%)	-85 (-2.7%)	107 (3.8%)
Dec	W	1190 (10.2%)	765 (7.1%)	1621 (13.9%)	835 (7.8%)
	AN	16 (0.3%)	150 (2.7%)	7 (0.1%)	498 (9%)
	BN	-172 (-5.1%)	-85 (-2.7%)	-146 (-4.3%)	586 (18.4%)
	D	-194 (-6.6%)	-132 (-4.7%)	-144 (-4.9%)	-156 (-5.6%)
	C	-202 (-8.4%)	-641 (-21.6%)	279 (11.6%)	18 (0.6%)
	All	278 (4.5%)	127 (2.2%)	499 (8.1%)	406 (7%)

[a] Positive values indicate higher flows under HOS or LOS than under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of scenarios.

Water Temperature

Simulated monthly water temperatures in the Feather River at the confluence with the Sacramento River were used to investigate the potential effects of BDCP operations on the suitability of water temperatures for splittail rearing on the mainstem Feather River. Table 5C.5.2-189 presents predicted year-round mean monthly water temperatures by water-year type in the Feather River at the confluence with the Sacramento River. Table 5C.5.2-190 presents the differences between pairs of model scenarios by month and water-year type. These results indicate that there would be very small (<3%) differences in mean monthly water temperature in the Feather River at the confluence in all months and water-year types between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. Further, there would be no differences in mean monthly water temperatures between the

ESO scenario and HOS and LOS scenarios (Table 5C.5.2-191, Table 5C.5.2-192). Because no differences in mean monthly temperatures were found, it was determined that no further temperature analyses on splittail in the Feather River are necessary.

Table 5C.5.2-189. Mean Monthly Water Temperature (°F) in the Feather River at the Confluence with the Sacramento River under EBC and ESO Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	47	47	48	48	47	48
	AN	46	46	47	48	47	48
	BN	46	45	46	47	46	47
	D	45	45	46	47	46	47
	C	45	45	46	48	46	48
	All	46	46	47	48	47	48
Feb	W	50	50	51	52	51	52
	AN	50	50	51	52	51	52
	BN	50	50	51	51	51	51
	D	50	50	51	52	51	52
	C	51	51	52	53	52	53
	All	50	50	51	52	51	52
Mar	W	53	53	54	55	54	55
	AN	54	54	55	56	55	56
	BN	55	55	56	57	56	57
	D	55	55	56	57	56	57
	C	56	56	57	58	57	58
	All	55	55	55	56	55	56
Apr	W	59	59	59	60	59	60
	AN	60	60	61	62	61	62
	BN	61	61	61	62	61	62
	D	62	62	63	64	63	64
	C	63	63	64	65	64	65
	All	61	61	61	63	61	62
May	W	65	65	66	68	66	67
	AN	66	66	68	69	68	69
	BN	67	67	68	69	68	69
	D	68	68	69	70	69	70
	C	68	68	70	71	70	71
	All	66	66	68	69	68	69
Jun	W	70	70	72	73	71	72
	AN	71	71	73	75	72	73
	BN	72	72	74	75	72	73
	D	73	73	75	77	74	76
	C	72	72	74	76	74	76
	All	71	71	73	75	72	74

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jul	W	74	73	75	76	75	77
	AN	72	72	74	75	73	75
	BN	73	73	74	76	75	76
	D	73	73	75	76	75	78
	C	75	75	77	79	79	81
	All	73	73	75	76	75	77
Aug	W	73	73	74	76	75	77
	AN	71	71	72	74	73	75
	BN	72	72	74	75	74	76
	D	72	72	74	76	75	77
	C	75	75	77	79	76	79
	All	73	73	74	76	75	77
Sep	W	71	67	68	70	69	71
	AN	70	67	68	70	69	71
	BN	70	70	71	73	72	74
	D	70	70	72	74	72	74
	C	70	70	72	74	72	74
	All	70	69	70	72	71	73
Oct	W	61	61	62	64	62	64
	AN	62	61	63	64	63	64
	BN	61	62	63	64	63	64
	D	61	61	62	64	62	64
	C	62	62	63	65	63	65
	All	61	61	62	64	62	64
Nov	W	52	52	53	55	53	55
	AN	53	53	54	56	54	56
	BN	53	53	54	55	54	55
	D	52	52	53	55	53	55
	C	53	53	54	56	54	56
	All	53	53	53	55	54	55
Dec	W	47	47	48	49	48	49
	AN	47	47	48	50	48	50
	BN	46	46	47	49	47	48
	D	46	46	47	49	47	49
	C	45	45	46	47	46	48
	All	46	46	47	49	47	49

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of scenarios.

Table 5C.5.2-190. Differences[a] between EBC and ESO Scenarios in Mean Monthly Water Temperature (°F) in the Feather River at the Confluence with the Sacramento River

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	1 (1.8%)	2 (4%)	1 (1.9%)	2 (4.1%)	-0.03 (-0.1%)	0 (0%)
	AN	1 (1.8%)	2 (4%)	1 (2%)	2 (4.2%)	-0.03 (-0.1%)	-0.01 (0%)
	BN	1 (1.6%)	2 (4%)	1 (1.9%)	2 (4.3%)	-0.1 (-0.2%)	0 (0%)
	D	1 (2%)	2 (4.7%)	1 (2.1%)	2 (4.9%)	-0.03 (-0.1%)	0.03 (0.1%)
	C	1 (2.1%)	2 (5.1%)	1 (2.2%)	2 (5.2%)	-0.05 (-0.1%)	0.03 (0.1%)
	All	1 (1.9%)	2 (4.3%)	1 (2%)	2 (4.5%)	-0.05 (-0.1%)	0 (0%)
Feb	W	1 (1.9%)	2 (3.8%)	1 (1.9%)	2 (3.8%)	0.04 (0.1%)	0 (0%)
	AN	1 (1.9%)	2 (3.8%)	1 (1.7%)	2 (3.6%)	0.03 (0.1%)	-0.1 (-0.1%)
	BN	1 (1.8%)	2 (3.4%)	1 (1.7%)	2 (3.4%)	0 (0%)	0 (0%)
	D	1 (1.9%)	2 (3.8%)	1 (1.9%)	2 (3.8%)	0.01 (0%)	0 (0%)
	C	1 (2%)	2 (4.3%)	1 (2%)	2 (4.3%)	0 (0%)	0 (0%)
	All	1 (1.9%)	2 (3.8%)	1 (1.8%)	2 (3.8%)	0 (0%)	0 (0%)
Mar	W	1 (1.3%)	2 (3.3%)	1 (1.2%)	2 (3.3%)	0 (0%)	0.05 (0.1%)
	AN	0 (0.8%)	1 (2.3%)	0 (0.6%)	1 (2.2%)	0 (0%)	-0.1 (-0.1%)
	BN	1 (1.4%)	2 (3.4%)	0.6 (1.2%)	2 (3.2%)	0.04 (0.1%)	0.03 (0.1%)
	D	0.8 (1.4%)	2 (3.1%)	1 (1.3%)	2 (3%)	0 (0%)	-0.04 (-0.1%)
	C	1 (1.7%)	2 (3.7%)	1 (1.6%)	2 (3.6%)	0 (0%)	0.04 (0.1%)
	All	1 (1.3%)	2 (3.2%)	1 (1.2%)	2 (3.1%)	0 (0%)	0 (0%)
Apr	W	1 (1%)	2 (2.7%)	1 (1%)	2 (2.8%)	0 (0%)	0 (0%)
	AN	1 (1.3%)	2 (3.2%)	1 (1.3%)	2 (3.2%)	0 (0%)	0 (0%)
	BN	1 (1%)	1 (2.3%)	1 (1%)	1 (2.3%)	0 (0%)	-0.2 (-0.4%)
	D	1 (1.3%)	2 (3.1%)	1 (1.3%)	2 (3.2%)	0 (0%)	-0.1 (-0.2%)
	C	1 (1.3%)	2 (3.3%)	1 (1.3%)	2 (3.3%)	-0.1 (-0.2%)	-0.1 (-0.2%)
	All	1 (1.2%)	2 (2.9%)	1 (1.2%)	2 (2.9%)	0 (0%)	-0.1 (-0.1%)
May	W	1 (2.1%)	3 (4.5%)	1 (2.1%)	3 (4.6%)	0 (0%)	-0.1 (-0.1%)
	AN	1 (1.7%)	3 (3.8%)	1 (1.7%)	3 (3.9%)	-0.3 (-0.5%)	-0.4 (-0.6%)
	BN	1 (1.9%)	2 (3.3%)	1 (1.9%)	2 (3.3%)	-0.1 (-0.1%)	-0.4 (-0.6%)
	D	1 (2.2%)	2 (3.6%)	1 (2.2%)	2 (3.6%)	-0.1 (-0.2%)	-0.2 (-0.3%)
	C	2 (2.4%)	3 (4%)	2 (2.3%)	3 (4%)	0.1 (0.2%)	0 (0%)
	All	1 (2.1%)	3 (3.9%)	1 (2.1%)	3 (3.9%)	-0.1 (-0.1%)	-0.2 (-0.3%)
Jun	W	1 (1.8%)	2 (3.4%)	1 (1.9%)	2 (3.4%)	-1 (-1%)	-1 (-1.5%)
	AN	1 (0.8%)	2 (2.4%)	1 (0.9%)	2 (2.5%)	-1 (-1.8%)	-2 (-2.2%)
	BN	0 (0%)	2 (2.3%)	0 (0%)	2 (2.3%)	-2 (-2.5%)	-2 (-2.3%)
	D	1.2 (1.6%)	3 (4.6%)	1.3 (1.7%)	3 (4.7%)	-1 (-0.9%)	-0.4 (-0.5%)
	C	2 (2.6%)	3 (4.8%)	2 (2.6%)	3 (4.8%)	0.2 (0.2%)	0 (0%)
	All	1 (1.4%)	3 (3.6%)	1 (1.5%)	3 (3.6%)	-1 (-1.2%)	-1 (-1.3%)
Jul	W	2 (2.2%)	3 (4.2%)	2 (2.3%)	3 (4.4%)	0.3 (0.4%)	0.5 (0.6%)
	AN	1.2 (1.6%)	3 (3.8%)	1.3 (1.9%)	3 (4%)	-0.1 (-0.1%)	0.1 (0.1%)
	BN	2 (2.5%)	4 (5.1%)	2 (2.6%)	4 (5.2%)	0.2 (0.3%)	1 (0.8%)
	D	3 (3.8%)	5 (7.2%)	3 (3.7%)	5 (7.1%)	1 (1.3%)	2 (2.5%)
	C	4 (5.7%)	6 (8.6%)	4 (5.1%)	6 (8%)	2 (2.5%)	2 (2.4%)
	All	2 (3%)	4 (5.6%)	2 (3%)	4 (5.6%)	1 (0.8%)	1 (1.3%)

Month	Water-Year Type[b]	Scenarios[c] EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Aug	W	1.6 (2.1%)	3 (4.7%)	2 (2.5%)	4 (5%)	0.5 (0.6%)	1 (1.2%)
	AN	1.5 (2.1%)	4 (5.1%)	1.6 (2.3%)	4 (5.2%)	0.4 (0.5%)	1 (1.2%)
	BN	2 (2.7%)	4 (5.3%)	2 (2.8%)	4 (5.4%)	0.3 (0.4%)	1 (1%)
	D	4 (4.9%)	6 (7.8%)	3 (4.2%)	5 (7%)	1 (1.4%)	1 (1.1%)
	C	2 (2.3%)	4 (5.7%)	2 (2.3%)	4 (5.7%)	-0.5 (-0.6%)	-0.1 (-0.1%)
	All	2 (2.9%)	4 (5.7%)	2 (2.8%)	4 (5.6%)	0.4 (0.6%)	1 (0.9%)
Sep	W	-1 (-2.1%)	0 (0.3%)	2 (3.6%)	4 (6.1%)	1 (1.7%)	1 (1.3%)
	AN	-1 (-0.9%)	1 (2%)	2 (3.6%)	4 (6.7%)	1 (1.8%)	2 (2.2%)
	BN	2 (2.4%)	4 (5.3%)	2 (2.6%)	4 (5.5%)	1 (1%)	1 (1%)
	D	2 (3.2%)	4 (6.2%)	2 (2.8%)	4 (5.7%)	0.1 (0.2%)	-0.1 (-0.1%)
	C	1 (2%)	4 (5.1%)	1 (2.1%)	4 (5.1%)	-0.2 (-0.3%)	-0.1 (-0.2%)
	All	0 (0.6%)	2 (3.4%)	2 (3%)	4 (5.8%)	0.7 (1%)	0.6 (0.8%)
Oct	W	1 (2%)	3 (5.1%)	1 (1.8%)	3 (4.9%)	-0.1 (-0.2%)	-0.1 (-0.1%)
	AN	1 (1.5%)	2 (3.8%)	1.1 (1.8%)	3 (4.1%)	-0.1 (-0.2%)	-0.2 (-0.3%)
	BN	1 (1.9%)	3 (5%)	1 (1.6%)	3 (4.6%)	-0.1 (-0.2%)	0.1 (0.2%)
	D	1 (1.5%)	3 (5.2%)	0.9 (1.4%)	3 (5.1%)	-0.2 (-0.3%)	0.1 (0.1%)
	C	2 (2.4%)	3 (5.2%)	1 (2.3%)	3 (5.1%)	0.05 (0.1%)	-0.03 (-0.1%)
	All	1 (1.9%)	3 (4.9%)	1 (1.7%)	3 (4.8%)	-0.1 (-0.2%)	0 (0%)
Nov	W	1 (1.7%)	3 (5.3%)	1 (1.7%)	3 (5.3%)	0 (0%)	0 (0%)
	AN	1 (2%)	3 (5.2%)	1 (1.9%)	3 (5.1%)	0 (0%)	-0.1 (-0.2%)
	BN	1 (1.9%)	3 (5.4%)	1 (1.9%)	3 (5.4%)	0 (0%)	0 (0%)
	D	1 (2%)	3 (5.4%)	1 (2%)	3 (5.4%)	0.1 (0.2%)	0 (0%)
	C	1 (1.9%)	3 (5.5%)	1 (1.9%)	3 (5.5%)	0.1 (0.2%)	0.1 (0.2%)
	All	1 (1.9%)	3 (5.4%)	1 (1.9%)	3 (5.4%)	0.05 (0.1%)	0 (0%)
Dec	W	1 (1.5%)	2 (4.1%)	1 (1.8%)	2 (4.4%)	-0.1 (-0.2%)	0 (0%)
	AN	1 (2.2%)	3 (5.7%)	1 (2.1%)	3 (5.5%)	-0.1 (-0.3%)	-0.3 (-0.5%)
	BN	1 (2.5%)	3 (5.8%)	1 (2.4%)	3 (5.7%)	0.1 (0.2%)	-0.1 (-0.2%)
	D	1.1 (2.4%)	3 (5.5%)	1 (2.5%)	3 (5.6%)	0.3 (0.7%)	-0.1 (-0.1%)
	C	1 (2.3%)	3 (6.3%)	1 (2.4%)	3 (6.4%)	0.4 (0.9%)	0.5 (1%)
	All	1 (2.1%)	2 (5.2%)	1 (2.2%)	2 (5.3%)	0.1 (0.2%)	0 (0%)

[a] Positive values indicate higher temperatures under ESO than under EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of scenarios.

Table 5C.5.2-191. Mean Monthly Water Temperature (°F) in the Feather River at the Confluence with the Sacramento River for ESO, HOS, and LOS Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	47	48	48	49	48	49
	AN	47	48	47	48	47	48
	BN	46	47	46	47	46	47
	D	46	47	46	47	46	47
	C	46	48	46	48	47	48
	All	47	48	47	48	47	48
Feb	W	51	52	51	52	51	52
	AN	51	52	51	52	51	52
	BN	51	51	51	51	51	51
	D	51	52	51	52	51	52
	C	52	53	52	53	52	53
	All	51	52	51	52	51	52
Mar	W	54	55	54	55	54	55
	AN	55	56	55	56	55	56
	BN	56	57	56	57	56	57
	D	56	57	56	57	56	57
	C	57	58	57	58	57	58
	All	55	56	55	56	55	56
Apr	W	59	60	58	59	59	60
	AN	61	62	60	61	61	62
	BN	61	62	60	61	61	62
	D	63	64	63	64	63	64
	C	64	65	64	65	64	65
	All	61	62	61	62	61	62
May	W	66	67	65	67	66	67
	AN	68	69	66	68	68	69
	BN	68	69	67	68	68	69
	D	69	70	69	70	69	70
	C	70	71	70	71	70	71
	All	68	69	67	69	68	69
Jun	W	71	72	72	73	71	72
	AN	72	73	73	75	72	73
	BN	72	73	73	74	71	73
	D	74	76	75	77	74	76
	C	74	76	74	76	74	76
	All	72	74	73	75	72	74
Jul	W	75	77	76	78	75	77
	AN	73	75	75	77	73	75
	BN	75	76	75	77	75	77
	D	75	78	76	78	75	78
	C	79	81	78	81	79	81
	All	75	77	76	78	75	77

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Aug	W	75	77	76	78	75	77
	AN	73	75	74	76	73	75
	BN	74	76	75	76	74	76
	D	75	77	75	77	75	77
	C	76	79	76	79	76	79
	All	75	77	75	77	75	77
Sep	W	69	71	70	71	73	75
	AN	69	71	70	72	71	73
	BN	72	74	72	74	72	74
	D	72	74	72	74	72	74
	C	72	74	72	73	72	74
	All	71	73	71	73	72	74
Oct	W	62	64	62	64	62	63
	AN	63	64	63	65	62	64
	BN	63	64	63	65	63	64
	D	62	64	62	64	62	64
	C	63	65	63	65	63	65
	All	62	64	63	64	62	64
Nov	W	53	55	53	55	53	55
	AN	54	56	54	56	54	56
	BN	54	55	54	55	53	55
	D	53	55	53	55	53	55
	C	54	56	54	56	54	56
	All	54	55	54	55	53	55
Dec	W	48	49	48	49	48	49
	AN	48	50	48	49	48	49
	BN	47	48	47	48	47	49
	D	47	49	47	49	47	48
	C	46	48	46	48	46	48
	All	47	49	47	49	47	49

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of scenarios.

Table 5C.5.2-192. Differences[a] between ESO Scenarios and HOS and LOS Scenarios in Mean Monthly Water Temperature (°F) in the Feather River at the Confluence with the Sacramento River

Month	Water-Year Type[b]	Scenario[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	0.1 (0.2%)	0.05 (0.1%)	0.1 (0.2%)	0.1 (0.3%)
	AN	0.03 (0.1%)	-0.04 (-0.1%)	0.05 (0.1%)	0.1 (0.1%)
	BN	0.04 (0.1%)	0 (0%)	0.03 (0.1%)	0 (0%)
	D	0 (0%)	-0.03 (-0.1%)	0 (0%)	0.1 (0.3%)
	C	0 (0%)	-0.1 (-0.3%)	0.3 (0.6%)	0 (0%)
	All	0.04 (0.1%)	0 (0%)	0.1 (0.2%)	0.1 (0.2%)
Feb	W	0.05 (0.1%)	0.1 (0.1%)	0 (0%)	0.1 (0.2%)
	AN	0 (0%)	0 (0%)	0 (0%)	0.05 (0.1%)
	BN	0.1 (0.1%)	0 (0%)	0.03 (0.1%)	0.1 (0.1%)
	D	0 (0%)	0 (0%)	0 (0%)	0.03 (0.1%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0.03 (0.1%)	0 (0%)	0.05 (0.1%)
Mar	W	0 (0%)	-0.04 (-0.1%)	0 (0%)	0 (0%)
	AN	-0.05 (-0.1%)	0 (0%)	-0.04 (-0.1%)	-0.04 (-0.1%)
	BN	-0.04 (-0.1%)	-0.1 (-0.1%)	0 (0%)	-0.04 (-0.1%)
	D	0 (0%)	0.1 (0.1%)	0 (0%)	0 (0%)
	C	-0.04 (-0.1%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	W	-1 (-1.6%)	-1 (-1.7%)	0 (0%)	0 (0%)
	AN	-1 (-1.9%)	-1 (-2%)	0 (0%)	0 (0%)
	BN	-2 (-2.8%)	-1 (-1.6%)	-0.04 (-0.1%)	0 (0%)
	D	-0.1 (-0.1%)	-0.1 (-0.1%)	0 (0%)	0 (0%)
	C	0.1 (0.2%)	0.1 (0.2%)	-0.03 (-0.1%)	0 (0%)
	All	-1 (-1.3%)	-1 (-1.1%)	0 (0%)	0 (0%)
May	W	-1 (-1.4%)	-1 (-1.3%)	0 (0%)	0 (0%)
	AN	-1 (-1.8%)	-1 (-1.3%)	0.2 (0.2%)	0 (0%)
	BN	-1 (-1.4%)	-0.4 (-0.5%)	0 (0%)	0.1 (0.2%)
	D	-0.1 (-0.2%)	-0.1 (-0.1%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	-1 (-1%)	-0.5 (-0.7%)	0 (0%)	0 (0%)
Jun	W	1 (1.2%)	1 (1.7%)	0 (0%)	0.2 (0.3%)
	AN	1 (1.7%)	2 (2.3%)	0 (0%)	0 (0%)
	BN	1 (1.7%)	0.4 (0.6%)	-0.3 (-0.3%)	0.05 (0.1%)
	D	1 (0.7%)	0.2 (0.2%)	-0.2 (-0.2%)	-0.05 (-0.1%)
	C	0 (0%)	0.1 (0.1%)	-0.1 (-0.1%)	0.1 (0.1%)
	All	1 (1.1%)	1 (1%)	-0.1 (-0.1%)	0.1 (0.1%)
Jul	W	1 (1.1%)	1 (1.3%)	0.04 (0.1%)	0.1 (0.2%)
	AN	2 (2.3%)	2 (2.4%)	0.05 (0.1%)	0.1 (0.1%)
	BN	1 (1%)	1 (0.9%)	0.2 (0.2%)	0.1 (0.1%)
	D	1 (0.8%)	0.3 (0.4%)	-0.3 (-0.5%)	-0.3 (-0.4%)
	C	-0.4 (-0.5%)	-0.4 (-0.5%)	0 (0%)	-0.1 (-0.1%)
	All	1 (0.9%)	1 (0.9%)	0 (0%)	0 (0%)

Month	Water-Year Type[b]	Scenario[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	1 (1.2%)	1 (1.4%)	0.1 (0.1%)	0 (0%)
	AN	1 (1.4%)	1 (1.4%)	-0.05 (-0.1%)	0 (0%)
	BN	1 (0.8%)	1 (0.9%)	-0.2 (-0.3%)	-0.2 (-0.2%)
	D	0.4 (0.5%)	0.1 (0.2%)	-0.3 (-0.4%)	-0.3 (-0.4%)
	C	-0.1 (-0.2%)	-0.2 (-0.3%)	0 (0%)	0.1 (0.2%)
	All	1 (0.8%)	1 (0.8%)	-0.1 (-0.1%)	-0.1 (-0.1%)
Sep	W	1 (0.8%)	1 (1%)	4 (5.3%)	4 (5.8%)
	AN	1 (1.3%)	1 (0.9%)	2 (2.9%)	2 (2.8%)
	BN	0.4 (0.5%)	0.4 (0.5%)	0.1 (0.1%)	0 (0%)
	D	-0.04 (-0.1%)	-0.3 (-0.4%)	-0.2 (-0.2%)	-0.3 (-0.4%)
	C	-0.3 (-0.4%)	-0.5 (-0.6%)	0.04 (0.1%)	0 (-0.1%)
	All	0.3 (0.4%)	0.2 (0.3%)	1 (2%)	2 (2.1%)
Oct	W	0.3 (0.5%)	0.2 (0.2%)	0 (0%)	-0.4 (-0.5%)
	AN	0.3 (0.5%)	0.5 (0.8%)	-0.1 (-0.2%)	-0.1 (-0.2%)
	BN	0.3 (0.5%)	0.2 (0.3%)	0.1 (0.2%)	-0.2 (-0.3%)
	D	0.4 (0.7%)	-0.03 (-0.1%)	0.1 (0.1%)	-0.3 (-0.5%)
	C	-0.3 (-0.5%)	-0.6 (-0.9%)	-0.2 (-0.3%)	-0.2 (-0.3%)
	All	0.3 (0.4%)	0.1 (0.1%)	0 (0%)	-0.3 (-0.4%)
Nov	W	0 (0%)	-0.2 (-0.4%)	-0.1 (-0.1%)	-0.3 (-0.5%)
	AN	0.1 (0.1%)	0.1 (0.1%)	-0.03 (-0.1%)	-0.1 (-0.2%)
	BN	0.1 (0.1%)	-0.2 (-0.3%)	-0.1 (-0.1%)	-0.2 (-0.4%)
	D	-0.1 (-0.1%)	-0.1 (-0.2%)	-0.2 (-0.3%)	-0.2 (-0.3%)
	C	-0.1 (-0.1%)	-0.3 (-0.6%)	-0.03 (-0.1%)	-0.1 (-0.2%)
	All	0 (0%)	-0.2 (-0.3%)	-0.1 (-0.1%)	-0.2 (-0.4%)
Dec	W	0.1 (0.2%)	0.1 (0.3%)	0.1 (0.3%)	0.1 (0.2%)
	AN	0.2 (0.4%)	-0.2 (-0.5%)	-0.04 (-0.1%)	-0.1 (-0.1%)
	BN	-0.2 (-0.4%)	-0.1 (-0.1%)	-0.2 (-0.5%)	0.2 (0.4%)
	D	-0.1 (-0.3%)	0 (0%)	-0.2 (-0.4%)	-0.3 (-0.5%)
	C	-0.2 (-0.4%)	-0.3 (-0.6%)	0.03 (0.1%)	0.05 (0.1%)
	All	-0.03 (-0.1%)	-0.04 (-0.1%)	-0.03 (-0.1%)	0 (0%)

[a] Positive values indicate higher temperature under HOS or LOS than under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of scenarios.

5C.5.2.4.5 White Sturgeon

5C.5.2.4.5.1 Egg/Embryo

Water Temperature

White sturgeon spawn and eggs incubate in the Feather River between February and June. Water temperature-related effects of the ESO on white sturgeon spawning and egg incubation habitat were evaluated in the Feather River below Thermalito Afterbay and at the confluence with the Sacramento River. Predicted mean monthly water temperatures by water-year type below Thermalito Afterbay are presented above in Table 5C.5.2-150 and differences between pairs of model scenarios are presented in Table 5C.5.2-151. Predicted mean monthly water temperatures by water-year type at the confluence are presented above in Table 5C.5.2-189 and differences between pairs of model scenarios are presented in Table 5C.5.2-190. These results indicate that there are negligible differences between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT in mean monthly water temperatures regardless of month, water-year type, or location within the Feather River. Further, there would be no differences in mean monthly water temperatures between the ESO scenario and HOS and LOS scenarios in the Feather River below Thermalito Afterbay (Table 5C.5.2-155, Table 5C.5.2-157) and at the confluence with the Sacramento River (Table 5C.5.2-191, Table 5C.5.2-192). Therefore, it was determined that no further temperature-related biological analyses in the Feather River on white sturgeon spawning and egg incubation are necessary.

Seasonal Flows

Mean monthly flows in the Feather River high-flow channel at Thermalito Afterbay and at the confluence with the Sacramento River during February through June were reviewed to determine whether the ESO would have flow-related effects on white sturgeon spawning and egg incubation habitat.

For the Feather River high-flow channel, average flows by month and water-year type for each model scenario are presented in Table 5C.5.2-123 and differences between pairs of model scenarios are presented in Table 5C.5.2-124. Monthly frequency of exceedance plots for flows are presented in Figure 5C.5.2-110 through Figure 5C.5.2-113. Flows under ESO_ELT and ESO_LLT during February through June would generally be greater than or similar to those under EBC2 ELT and EBC2_LLT, respectively, with few small to moderate flow reductions during some months and water-year types. Compared to the frequent increases in flows during the period, these flow reductions are infrequent enough to have no biologically meaningful effects on white sturgeon spawning and egg incubation. Therefore, the ESO would provide a small to moderate flow-related benefit to white sturgeon spawning and egg incubation in the Feather River high-flow channel. Flows under LOS scenarios in the high-flow channel would generally be similar to or greater than flows under ESO during February through June (Table 5C.5.2-127, Table 5C.5.2-128). Flows under HOS would generally be similar to or greater than flows under ESO during February through May. Flows during June under HOS would be lower than flows under ESO, but would still be higher than those under EBC2. Therefore, HOS and LOS would provide a greater flow-related benefit than the ESO to white sturgeon spawning and egg incubation in the Feather River high-flow channel.

For the Feather River at the confluence with the Sacramento River, average flows by month and water-year type for each model scenario are presented in Table 5C.5.2-185 and differences between pairs of model scenarios are presented in Table 5C.5.2-186. Monthly frequency of exceedance plots for flows for February through June are presented in Figure 5C.5.2-124 through Figure 5C.5.2-128. Flows under ESO_ELT and ESO_LLT during February through June would generally be greater than or similar to those under EBC2 ELT and EBC2_LLT, respectively, with few exceptions that would not be of sufficient magnitude to have a biologically meaningful effect on white sturgeon. Therefore, the ESO would provide a small flow-related benefit to white sturgeon spawning and egg incubation in the Feather River at the confluence. Flows during February through June under HOS and LOS scenarios at the confluence with the Sacramento River would generally be similar to or greater than flows under ESO in all months. Flows would be particularly higher in April and May under the HOS (20% to 30% higher for all model scenarios combined). Flows would be lower during June relative to the ESO, although overall, flows under LOS would have similar effects to white sturgeon spawning and egg incubation habitat as the ESO. Also, HOS would provide a greater flow-related benefit than the ESO to white sturgeon spawning and egg incubation in the Feather River high-flow channel.

5C.5.2.4.5.2 Larvae

Water Temperature

To investigate temperatures further downstream in the Feather River for larval rearing, the Reclamation temperature model was used to evaluate spring (February through June) seasonal water temperature distributions at Honcut Creek and at the confluence with the Sacramento River.

Average predicted water temperatures by month and water-year type for each model scenario are presented for the Feather River at Honcut Creek in Table 5C.5.2-193 and differences between pairs of model scenarios are presented in Table 5C.5.2-194. Average predicted water temperatures by month and water-year type for each model scenario are presented for the Feather River at the confluence with the Sacramento River in Table 5C.5.2-189 and differences between pairs of model scenarios are presented in Table 5C.5.2-190. These results suggest that, at both locations, there would be very small (<4%) differences in mean water temperatures in all months and water-year types between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT during the February through June larval rearing period. Mean monthly water temperatures under HOS and LOS scenarios during February through June at Honcut Creek would not be different from temperatures under ESO (Table 5C.5.2-195, Table 5C.5.2-196). Therefore, it was concluded that there would be no temperature-related effects of ESO, HOS, or LOS scenarios on larval rearing conditions for white sturgeon in the Feather River and no further temperature-related biological analyses in the Feather River on white sturgeon larval rearing are necessary.

Table 5C.5.2-193. Mean Monthly Water Temperature (°F) in the Feather River at Honcut Creek under EBC and ESO Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	47	47	48	50	48	50
	AN	46	46	48	49	48	49
	BN	46	46	47	49	47	49
	D	45	45	47	48	47	48
	C	46	46	48	49	47	49
	All	46	46	48	49	48	49
Feb	W	49	49	50	52	50	52
	AN	49	50	51	53	51	52
	BN	50	50	51	53	51	53
	D	50	50	52	53	52	53
	C	51	51	53	54	53	54
	All	50	50	51	53	51	53
Mar	W	52	52	53	54	53	54
	AN	53	53	53	55	53	55
	BN	54	54	55	57	55	57
	D	55	55	56	58	56	58
	C	55	55	56	58	56	58
	All	53	54	54	56	55	56

Month	Water-Year Type[a]	Scenario[b] EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Apr	W	56	56	57	58	57	58
	AN	59	59	60	61	60	61
	BN	60	60	60	62	60	61
	D	60	60	61	62	61	62
	C	59	59	61	62	60	62
	All	58	58	59	61	59	60
May	W	62	62	64	65	64	65
	AN	65	65	66	67	65	66
	BN	65	65	66	67	66	66
	D	65	65	66	67	66	67
	C	65	65	67	68	67	68
	All	64	64	66	67	65	66
Jun	W	67	67	69	70	68	68
	AN	69	69	71	72	69	69
	BN	69	69	71	72	68	69
	D	70	70	71	73	70	72
	C	69	69	71	73	71	72
	All	69	69	70	72	69	70
Jul	W	71	71	71	72	72	72
	AN	69	69	70	71	70	71
	BN	69	69	70	72	71	72
	D	69	69	71	72	72	74
	C	71	72	73	76	76	78
	All	70	70	71	72	72	73
Aug	W	72	71	71	72	72	73
	AN	69	68	69	71	70	72
	BN	69	69	71	72	71	73
	D	68	69	71	73	72	74
	C	72	72	74	76	73	76
	All	70	70	71	73	72	74
Sep	W	66	62	63	64	64	66
	AN	66	62	63	65	65	67
	BN	67	67	67	69	67	69
	D	66	66	67	70	67	69
	C	66	66	68	71	68	71
	All	66	64	65	68	66	68
Oct	W	59	59	60	63	60	63
	AN	60	60	61	64	61	63
	BN	60	60	61	64	61	64
	D	59	59	60	63	60	63
	C	60	60	61	64	61	64
	All	60	60	61	63	61	63

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Nov	W	53	53	54	57	54	57
	AN	54	54	55	58	55	57
	BN	53	53	54	57	54	57
	D	53	53	54	57	54	57
	C	54	54	55	57	55	58
	All	53	53	54	57	54	57
Dec	W	47	47	49	51	49	51
	AN	47	47	49	52	49	51
	BN	46	47	48	51	48	50
	D	46	47	48	50	48	50
	C	46	46	47	50	47	50
	All	47	47	48	51	48	51

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of scenarios.

Table 5C.5.2-194. Differences[a] between EBC and ESO Scenarios in Mean Monthly Water Temperature (°F) in the Feather River at Honcut Creek

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	1 (2.5%)	3 (5.7%)	1 (2.6%)	3 (5.8%)	-0.05 (-0.1%)	0 (0%)
	AN	1 (2.8%)	3 (6.2%)	1 (2.8%)	3 (6.3%)	-0.1 (-0.2%)	-0.04 (-0.1%)
	BN	1 (2.4%)	3 (6%)	1 (2.7%)	3 (6.4%)	-0.2 (-0.4%)	0.04 (0.1%)
	D	1 (2.8%)	3 (6.4%)	1 (3%)	3 (6.6%)	0.1 (0.1%)	0.1 (0.2%)
	C	1 (3.1%)	3 (7.2%)	2 (3.3%)	3 (7.4%)	-0.1 (-0.2%)	0.1 (0.1%)
	All	1 (2.7%)	3 (6.2%)	1 (2.9%)	3 (6.4%)	-0.1 (-0.1%)	0.04 (0.1%)
Feb	W	1 (2.5%)	3 (5.1%)	1 (2.4%)	2 (5%)	0.04 (0.1%)	-0.2 (-0.3%)
	AN	1 (2.8%)	3 (5.8%)	1 (2.3%)	3 (5.3%)	-0.2 (-0.4%)	-0.2 (-0.3%)
	BN	2 (3.3%)	3 (6.1%)	1 (3%)	3 (5.7%)	0.1 (0.1%)	0.04 (0.1%)
	D	1 (2.9%)	3 (5.6%)	1 (2.8%)	3 (5.5%)	0.03 (0.1%)	0.01 (0%)
	C	1 (2.9%)	3 (6%)	1 (2.9%)	3 (6%)	0 (0%)	0 (0%)
	All	1 (2.8%)	3 (5.6%)	1 (2.6%)	3 (5.4%)	0 (0%)	-0.1 (-0.1%)
Mar	W	1 (1.8%)	2 (4.7%)	1 (1.8%)	2 (4.6%)	0.1 (0.1%)	0.1 (0.3%)
	AN	0 (0.8%)	2 (3.1%)	0 (0.5%)	1 (2.8%)	0.1 (0.1%)	-0.1 (-0.2%)
	BN	2 (2.9%)	3 (6%)	1.2 (2.1%)	3 (5.2%)	0.2 (0.4%)	0.2 (0.4%)
	D	1.2 (2.2%)	2 (4.5%)	1 (1.9%)	2 (4.2%)	0 (0%)	0 (0%)
	C	1 (2.5%)	3 (5.2%)	1 (2.5%)	3 (5.1%)	0.1 (0.3%)	0.1 (0.1%)
	All	1 (2.1%)	3 (4.7%)	1 (1.8%)	2 (4.5%)	0.1 (0.2%)	0.1 (0.1%)
Apr	W	1 (1.3%)	2 (3.7%)	1 (1.3%)	2 (3.7%)	0 (0%)	0 (0%)
	AN	1 (1.5%)	2 (4%)	1 (1.6%)	2 (4%)	0 (0%)	0.1 (0.1%)
	BN	1 (1.1%)	2 (2.8%)	1 (1.1%)	2 (2.9%)	0 (0%)	-0.3 (-0.4%)
	D	1 (1.7%)	2 (3.7%)	1 (1.7%)	2 (3.7%)	0 (0%)	-0.1 (-0.2%)
	C	1 (1.7%)	3 (4.2%)	1 (1.8%)	3 (4.3%)	-0.1 (-0.1%)	0.05 (0.1%)
	All	1 (1.4%)	2 (3.6%)	1 (1.5%)	2 (3.7%)	0 (0%)	-0.1 (-0.1%)

Month	Water-Year Type[b]	Scenarios[c] EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
May	W	2 (2.5%)	3 (4.7%)	2 (2.5%)	3 (4.7%)	0 (0%)	-0.2 (-0.4%)
	AN	1 (1%)	2 (2.4%)	1 (0.9%)	2 (2.4%)	-0.6 (-0.9%)	-1 (-0.8%)
	BN	1 (1.8%)	1 (2.1%)	1 (1.8%)	1 (2.1%)	-0.1 (-0.2%)	-1 (-0.9%)
	D	1 (1.9%)	2 (2.8%)	1 (1.9%)	2 (2.8%)	-0.1 (-0.2%)	-0.2 (-0.3%)
	C	1 (2.2%)	2 (3.5%)	1 (2.2%)	2 (3.5%)	0.04 (0.1%)	-0.1 (-0.1%)
	All	1 (2%)	2 (3.3%)	1 (2%)	2 (3.3%)	-0.1 (-0.2%)	-0.3 (-0.5%)
Jun	W	1 (1.1%)	1 (1.7%)	1 (1.1%)	1 (1.8%)	-1 (-1.9%)	-2 (-2.4%)
	AN	0 (-0.7%)	0 (0%)	0 (-0.6%)	0 (0.1%)	-2 (-2.9%)	-2 (-3.5%)
	BN	-2 (-2.2%)	0 (-0.3%)	-2 (-2.2%)	0 (-0.3%)	-3 (-3.8%)	-2 (-3.4%)
	D	0.5 (0.7%)	2 (3.5%)	0.5 (0.8%)	3 (3.6%)	-1 (-1.2%)	-1 (-0.7%)
	C	2 (2.4%)	3 (4.5%)	2 (2.4%)	3 (4.4%)	0.2 (0.2%)	-0.1 (-0.1%)
	All	0 (0.4%)	1 (1.9%)	0 (0.4%)	1 (2%)	-1 (-1.9%)	-1 (-2%)
Jul	W	1 (0.7%)	1 (1.9%)	1 (1%)	2 (2.1%)	0.3 (0.4%)	1 (0.8%)
	AN	0.6 (0.8%)	2 (2.5%)	0.8 (1.2%)	2 (2.9%)	-0.1 (-0.1%)	0.1 (0.2%)
	BN	2 (2.2%)	3 (4.6%)	2 (2.2%)	3 (4.6%)	0.3 (0.5%)	1 (1.2%)
	D	3 (3.9%)	5 (7.3%)	3 (3.8%)	5 (7.3%)	1 (1.7%)	2 (3.4%)
	C	5 (6.7%)	7 (9.9%)	4 (5.8%)	6 (9%)	3 (3.5%)	3 (3.4%)
	All	2 (2.6%)	3 (4.8%)	2 (2.6%)	3 (4.8%)	1 (1.1%)	1 (1.8%)
Aug	W	0.3 (0.5%)	2 (2.6%)	1 (1%)	2 (3.1%)	0.4 (0.6%)	1 (1.6%)
	AN	1.3 (1.9%)	3 (4.8%)	1.4 (2.1%)	3 (5%)	1 (0.9%)	1 (2%)
	BN	2 (2.8%)	4 (5.4%)	2 (2.9%)	4 (5.5%)	1 (0.7%)	1 (1.8%)
	D	4 (5.7%)	6 (8.2%)	3 (4.8%)	5 (7.3%)	2 (2.2%)	1 (1.5%)
	C	2 (2.2%)	4 (5.7%)	1 (1.8%)	4 (5.3%)	-1 (-0.8%)	-0.2 (-0.2%)
	All	2 (2.4%)	4 (5.1%)	2 (2.4%)	4 (5%)	1 (0.8%)	1 (1.4%)
Sep	W	-2 (-2.9%)	0 (-0.7%)	2 (3.5%)	4 (5.7%)	1 (2%)	1 (1.7%)
	AN	-1 (-1.4%)	1 (1.4%)	2 (4%)	4 (6.9%)	2 (2.4%)	2 (2.9%)
	BN	1 (1.3%)	3 (4.4%)	1 (1.3%)	3 (4.4%)	0 (0%)	0.1 (0.1%)
	D	1 (2.1%)	4 (5.4%)	1 (2.1%)	4 (5.3%)	0 (0%)	-0.3 (-0.4%)
	C	2 (2.5%)	4 (6.6%)	2 (2.8%)	5 (6.9%)	0.1 (0.1%)	-0.2 (-0.2%)
	All	0 (0%)	2 (2.9%)	2 (2.7%)	4 (5.7%)	0.6 (0.9%)	0.5 (0.8%)
Oct	W	1 (2.1%)	4 (6.2%)	1 (1.8%)	4 (6%)	-0.1 (-0.2%)	-0.2 (-0.3%)
	AN	1 (1.7%)	3 (4.9%)	1.2 (2%)	3 (5.2%)	-0.1 (-0.2%)	-0.3 (-0.5%)
	BN	1 (1.9%)	4 (5.9%)	1 (1.5%)	3 (5.6%)	-0.2 (-0.3%)	-0.1 (-0.1%)
	D	1 (1.8%)	4 (7%)	1 (1.8%)	4 (6.9%)	-0.3 (-0.5%)	0.1 (0.1%)
	C	2 (2.5%)	4 (6.4%)	1 (2.4%)	4 (6.2%)	0 (0%)	0.1 (0.1%)
	All	1 (2%)	4 (6.2%)	1 (1.9%)	4 (6%)	-0.1 (-0.2%)	-0.1 (-0.1%)
Nov	W	1 (2.2%)	4 (7.7%)	1 (2.2%)	4 (7.6%)	0.02 (0%)	-0.04 (-0.1%)
	AN	1 (2.6%)	4 (6.8%)	1 (2.4%)	4 (6.7%)	0.05 (0.1%)	-0.2 (-0.4%)
	BN	1 (2.2%)	4 (7.3%)	1 (2.4%)	4 (7.5%)	0 (0%)	-0.1 (-0.1%)
	D	2 (3.1%)	4 (8%)	2 (3%)	4 (8%)	0.1 (0.2%)	-0.1 (-0.2%)
	C	1 (2.3%)	4 (7.6%)	1 (2.2%)	4 (7.5%)	0.03 (0.1%)	0.2 (0.3%)
	All	1 (2.5%)	4 (7.5%)	1 (2.4%)	4 (7.5%)	0.03 (0.1%)	-0.1 (-0.1%)

Month	Water-Year Type[b]	Scenarios[c] EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Dec	W	1 (2.8%)	3 (7%)	1 (3.1%)	3 (7.4%)	-0.1 (-0.2%)	-0.03 (-0.1%)
	AN	2 (3.2%)	4 (8.6%)	1 (3%)	4 (8.3%)	-0.1 (-0.2%)	-0.3 (-0.5%)
	BN	2 (3.6%)	4 (8.5%)	2 (3.5%)	4 (8.3%)	0.2 (0.4%)	-0.1 (-0.2%)
	D	1.8 (3.9%)	4 (8%)	2 (3.8%)	4 (7.9%)	0.1 (0.3%)	-0.2 (-0.3%)
	C	1 (2.6%)	4 (8.3%)	1 (2.7%)	4 (8.4%)	-0.1 (-0.1%)	0.3 (0.6%)
	All	1 (3.2%)	4 (7.9%)	2 (3.3%)	4 (7.9%)	0 (0%)	-0.1 (-0.1%)

[a] Positive values indicate higher temperature under ESO than under EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of scenarios.

Table 5C.5.2-195. Mean Monthly Water Temperature (°F) in the Feather River at Honcut Creek for ESO, HOS, and LOS Scenarios

Month	Water-Year Type[a]	Scenario[b] ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	48	50	48	50	48	50
	AN	48	49	48	49	48	50
	BN	47	49	47	49	47	49
	D	47	48	47	48	47	48
	C	47	49	47	49	48	49
	All	48	49	48	49	48	49
Feb	W	50	52	50	52	50	52
	AN	51	52	51	52	51	52
	BN	51	53	51	53	51	53
	D	52	53	52	53	52	53
	C	53	54	53	54	53	54
	All	51	53	51	53	51	53
Mar	W	53	54	53	54	53	54
	AN	53	55	53	55	53	54
	BN	55	57	55	57	55	57
	D	56	58	56	58	56	58
	C	56	58	56	58	56	58
	All	55	56	55	56	54	56
Apr	W	57	58	56	57	57	58
	AN	60	61	58	59	60	61
	BN	60	61	58	60	60	61
	D	61	62	60	62	61	62
	C	60	62	61	62	61	62
	All	59	60	58	60	59	61
May	W	64	65	62	64	64	65
	AN	65	66	63	65	66	66
	BN	66	66	65	66	66	67
	D	66	67	66	67	66	67
	C	67	68	67	68	67	68
	All	65	66	64	66	65	66

Month	Water-Year Type[a]	Scenario[b] ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jun	W	68	68	69	70	68	69
	AN	69	69	71	72	69	69
	BN	68	69	70	70	68	69
	D	70	72	71	73	70	72
	C	71	72	71	72	71	73
	All	69	70	70	71	69	70
Jul	W	72	72	73	74	72	73
	AN	70	71	72	73	70	71
	BN	71	72	72	73	71	73
	D	72	74	73	75	71	74
	C	76	78	75	77	76	78
	All	72	73	73	74	72	73
Aug	W	72	73	73	75	72	73
	AN	70	72	71	74	70	72
	BN	71	73	72	74	71	73
	D	72	74	73	74	72	74
	C	73	76	73	76	73	76
	All	72	74	73	75	72	74
Sep	W	64	66	65	67	67	69
	AN	65	67	66	68	66	68
	BN	67	69	68	70	67	69
	D	67	69	67	69	67	69
	C	68	71	68	70	68	71
	All	66	68	67	69	67	69
Oct	W	60	63	61	63	60	62
	AN	61	63	62	64	61	63
	BN	61	64	62	64	61	63
	D	60	63	61	63	60	63
	C	61	64	61	63	61	63
	All	61	63	61	63	61	63
Nov	W	54	57	54	57	54	56
	AN	55	57	55	58	55	57
	BN	54	57	55	57	54	56
	D	54	57	54	57	54	56
	C	55	58	54	57	55	57
	All	54	57	54	57	54	57
Dec	W	49	51	49	51	49	51
	AN	49	51	49	51	49	51
	BN	48	50	48	50	48	51
	D	48	50	48	50	48	50
	C	47	50	47	50	47	50
	All	48	51	48	50	48	50

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of scenarios.

Table 5C.5.2-196. Differences[a] between ESO Scenarios and HOS and LOS Scenarios in Mean Monthly Water Temperature (°F) in the Feather River at Honcut Creek

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	0.1 (0.2%)	0.1 (0.1%)	0.1 (0.1%)	0.2 (0.3%)
	AN	0.1 (0.3%)	-0.1 (-0.1%)	0.04 (0.1%)	0.1 (0.3%)
	BN	0.2 (0.4%)	0 (0%)	-0.04 (-0.1%)	0 (0%)
	D	0.04 (0.1%)	-0.03 (-0.1%)	-0.04 (-0.1%)	0.1 (0.2%)
	C	-0.1 (-0.2%)	-0.1 (-0.2%)	0.2 (0.5%)	-0.03 (-0.1%)
	All	0.1 (0.1%)	0 (0%)	0.05 (0.1%)	0.1 (0.2%)
Feb	W	0.1 (0.2%)	0.1 (0.3%)	0.03 (0.1%)	0.2 (0.4%)
	AN	0.2 (0.4%)	-0.1 (-0.2%)	-0.03 (-0.1%)	0.03 (0.1%)
	BN	-0.1 (-0.1%)	-0.2 (-0.3%)	-0.1 (-0.2%)	-0.1 (-0.2%)
	D	-0.05 (-0.1%)	0 (0%)	0 (0%)	0.1 (0.2%)
	C	0.03 (0.1%)	0.1 (0.2%)	0.1 (0.2%)	0 (0%)
	All	0.1 (0.1%)	0 (0%)	0 (0%)	0.1 (0.1%)
Mar	W	0.04 (0.1%)	-0.1 (-0.1%)	-0.03 (-0.1%)	0.05 (0.1%)
	AN	0 (0%)	0 (0%)	-0.2 (-0.3%)	-0.2 (-0.4%)
	BN	-0.2 (-0.4%)	-0.2 (-0.4%)	-0.2 (-0.4%)	-0.2 (-0.3%)
	D	0 (0%)	0.1 (0.2%)	0 (0%)	0.03 (0.1%)
	C	-0.1 (-0.2%)	0 (0%)	-0.1 (-0.1%)	-0.04 (-0.1%)
	All	-0.05 (-0.1%)	-0.04 (-0.1%)	-0.1 (-0.1%)	-0.05 (-0.1%)
Apr	W	-1 (-2%)	-1 (-2.1%)	0 (0%)	0.1 (0.1%)
	AN	-2 (-3%)	-2 (-3.3%)	0 (0%)	0 (0%)
	BN	-2 (-4%)	-2 (-2.9%)	0 (0%)	0.05 (0.1%)
	D	-0.2 (-0.3%)	0.05 (0.1%)	0.05 (0.1%)	0 (0%)
	C	0.1 (0.2%)	0.2 (0.3%)	0 (0%)	0 (0%)
	All	-1 (-1.8%)	-1 (-1.5%)	0 (0%)	0.04 (0.1%)
May	W	-2 (-2.4%)	-1 (-1.7%)	0 (0%)	0 (0%)
	AN	-2 (-3.1%)	-1 (-2.1%)	0.2 (0.4%)	0 (0%)
	BN	-2 (-2.3%)	-0.5 (-0.7%)	0 (0%)	0.2 (0.3%)
	D	-0.2 (-0.3%)	-0.1 (-0.2%)	0 (0%)	-0.1 (-0.1%)
	C	0 (0%)	0.1 (0.1%)	0 (0%)	0.1 (0.1%)
	All	-1 (-1.6%)	-1 (-0.9%)	0 (0%)	0.03 (0.1%)
Jun	W	1 (2.1%)	2 (2.5%)	0 (0%)	0.3 (0.5%)
	AN	2 (2.7%)	2 (3.4%)	-0.1 (-0.1%)	0 (0%)
	BN	2 (2.6%)	1 (1.2%)	-0.4 (-0.6%)	0 (0%)
	D	1 (1%)	0.2 (0.3%)	-0.2 (-0.3%)	-0.1 (-0.1%)
	C	0 (0%)	0 (0%)	-0.1 (-0.1%)	0.1 (0.1%)
	All	1 (1.7%)	1 (1.5%)	-0.1 (-0.2%)	0.1 (0.1%)
Jul	W	1 (1.5%)	1 (1.8%)	0.05 (0.1%)	0.2 (0.2%)
	AN	2 (3.4%)	2 (3.4%)	0.05 (0.1%)	0.1 (0.2%)
	BN	1 (1.4%)	1 (1.3%)	0.2 (0.3%)	0.1 (0.2%)
	D	1 (1.1%)	0.4 (0.6%)	-0.4 (-0.6%)	-0.4 (-0.5%)
	C	-1 (-0.7%)	-1 (-1.1%)	0.1 (0.1%)	-0.4 (-0.5%)
	All	1 (1.3%)	1 (1.2%)	0 (0%)	-0.04 (-0.1%)

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	2 (2.1%)	1 (1.9%)	0.2 (0.2%)	0 (0%)
	AN	2 (2.2%)	2 (2.2%)	-0.1 (-0.1%)	0.04 (0.1%)
	BN	1 (1.3%)	1 (1.8%)	-0.3 (-0.4%)	-0.2 (-0.3%)
	D	0.3 (0.4%)	0.1 (0.1%)	-0.3 (-0.4%)	-0.4 (-0.5%)
	C	-0.1 (-0.1%)	-0.1 (-0.2%)	0 (0%)	0 (0%)
	All	1 (1.3%)	1 (1.2%)	-0.1 (-0.1%)	-0.1 (-0.2%)
Sep	W	1 (1.2%)	1 (1.7%)	3 (5%)	4 (5.7%)
	AN	1 (1.9%)	1 (1.7%)	1 (2.1%)	1 (2.1%)
	BN	1 (1.3%)	1 (1.4%)	0.1 (0.1%)	0 (0%)
	D	-0.2 (-0.3%)	-0.2 (-0.3%)	0.1 (0.1%)	-0.2 (-0.3%)
	C	-0.1 (-0.2%)	-1 (-0.9%)	-0.1 (-0.1%)	-0.2 (-0.3%)
	All	1 (0.8%)	1 (0.8%)	1 (1.9%)	1 (1.9%)
Oct	W	1 (1%)	0.3 (0.6%)	0 (0%)	-1 (-1.1%)
	AN	0.4 (0.6%)	1 (1.5%)	-0.1 (-0.2%)	-0.3 (-0.5%)
	BN	1 (1.2%)	1 (0.8%)	0.2 (0.3%)	-0.3 (-0.4%)
	D	1 (1.2%)	-0.1 (-0.2%)	0.1 (0.1%)	-1 (-1.1%)
	C	-0.04 (-0.1%)	-1 (-1.6%)	-0.2 (-0.3%)	-0.3 (-0.5%)
	All	1 (0.9%)	0.1 (0.2%)	0 (0%)	-1 (-0.8%)
Nov	W	0.2 (0.4%)	-0.2 (-0.4%)	-0.1 (-0.2%)	-1 (-1.2%)
	AN	0.1 (0.3%)	0.4 (0.6%)	-0.1 (-0.1%)	-0.3 (-0.6%)
	BN	0.3 (0.5%)	-0.2 (-0.3%)	-0.2 (-0.4%)	-0.5 (-0.8%)
	D	-0.1 (-0.1%)	-0.3 (-0.5%)	-0.4 (-0.7%)	-0.5 (-0.9%)
	C	-0.3 (-0.6%)	-1 (-1.6%)	-0.1 (-0.2%)	-0.2 (-0.4%)
	All	0.1 (0.1%)	-0.3 (-0.5%)	-0.2 (-0.3%)	-0.5 (-0.9%)
Dec	W	0.1 (0.2%)	0.2 (0.4%)	0 (0%)	0.1 (0.1%)
	AN	0.2 (0.5%)	-0.3 (-0.5%)	-0.1 (-0.2%)	-0.2 (-0.4%)
	BN	-0.3 (-0.6%)	-0.2 (-0.5%)	-0.5 (-1%)	0.1 (0.2%)
	D	-0.2 (-0.4%)	0.1 (0.3%)	-0.3 (-0.7%)	-0.3 (-0.6%)
	C	-0.4 (-0.7%)	-0.4 (-0.7%)	-0.03 (-0.1%)	0.1 (0.2%)
	All	-0.1 (-0.2%)	-0.04 (-0.1%)	-0.2 (-0.3%)	-0.04 (-0.1%)

[a] Positive values indicate higher temperature under HOS or LOS than under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of scenarios.

5C.5.2.4.5.3 Juvenile

Water Temperature

Year-round simulated monthly water temperatures in the Feather River at Honcut Creek and the confluence with the Sacramento River were used to investigate the potential effects of BDCP operations on the suitability of juvenile rearing conditions for white sturgeon in the Feather River. Average predicted water temperatures by month and water-year type for each model scenario are presented for the Feather River at Honcut Creek in Table 5C.5.2-193 and differences between pairs of model scenarios are presented in Table 5C.5.2-194. Average predicted water temperatures by month and water-year type for each model scenario are presented for the Feather River at the confluence with the Sacramento River in Table 5C.5.2-189 and differences between pairs of model scenarios are presented in Table 5C.5.2-190. These results suggest that, at both locations, there would be very small (<4%) differences in mean water temperatures in all months of the year and water-year types between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. Further, there would be no differences in water temperatures at Honcut Creek or at the confluence with the Sacramento River (Table 5C.5.2-191, Table 5C.5.2-192, Table 5C.5.2-195, Table 5C.5.2-196). Therefore, it was concluded that there would be no temperature-related effects of ESO, HOS, and LOS scenarios on juvenile rearing conditions for white sturgeon in the Feather River and no further temperature-related biological analyses in the Feather River on white sturgeon juvenile rearing are necessary.

5C.5.2.4.5.4 Adult

Water Temperature

The analysis of water temperature-related effects of the ESO on spawning adult white sturgeon in the Feather River are presented as part of the Egg and Embryo section above. These results indicate that there would be no temperature-related effects of ESO, HOS, LOS scenarios on white sturgeon spawners in the Feather River throughout the February through June spawning period.

Seasonal Flows

The analysis of flow-related effects of the ESO on spawning adult white sturgeon in the Feather River are presented as part of the Egg and Embryo section above. These results indicate that there would be a small to moderate benefit of ESO, HOS, and LOS scenarios on the value and quantity of white sturgeon spawning habitat during the February through June spawning period that could lead to improved year class strength in the Feather River.

5C.5.2.4.6 Green Sturgeon

5C.5.2.4.6.1 Egg/Embryo

Water Temperature

Green sturgeon likely spawn in the Feather River, although information on the extent of spawning is limited and the Biological Review Team (National Marine Fisheries Service 2005) concluded that a significant population of spawning green sturgeon no longer exists in this river. Green sturgeon spawning locations within the Feather River appear to be limited to reaches just downstream of the Thermalito Afterbay Outlet (RM 59) and Gridley Bridge (RM 51) (U.S. Fish and Wildlife Service 1995). Green sturgeon spawning near Thermalito Afterbay Outlet was confirmed in June 2011 (A. Seesholtz pers. comm.). Predicted water temperatures from the Reclamation Temperature Model in the high-flow channel (below the Thermalito Afterbay) were used to represent this reach. Green sturgeon spawn between February and June. Predicted mean monthly water temperatures by water-year type in the high-flow channel are presented above in Table 5C.5.2-150 and differences between pairs of model scenarios are presented in Table 5C.5.2-151. These results indicate that there are negligible differences between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT in mean monthly water temperatures during February through June regardless of month or water-year type. Further, water temperatures under HOS and LOS scenarios would not be different from those under ESO during February through June in the high-flow channel (Table 5C.5.2-155, Table 5C.5.2-157).

The exceedances of monthly water temperatures above a 64°F threshold at Gridley, a proxy for Gridley Bridge, during May through September requested by NMFS were evaluated for green sturgeon spawning, egg incubation, and larval rearing (Section 5C.4, Table 5C.4-3).

Table 5C.5.2-197 reports the percent of months during the 82-year modeling period for each month during May through September that exceeded the 64°F threshold by 1°F to 5°F in 1°F increments for each scenario. Table 5C.5.2-198 presents differences between model scenarios in these percent values. Spawning and egg incubation does not generally extend beyond June. During May and June, the percent of months exceeding the threshold under ESO_ELT and ESO_LLT would be similar to or up to 27% (absolute scale) lower than the percent under EBC2_ELT and EBC2_LLT, respectively. Likewise, the percent of months exceeding the threshold under HOS and LOS scenarios during May and June would be similar or up to 40% (absolute scale) lower than the percent under EBC2 scenarios. These results correspond to a moderately large benefit of ESO, HOS, and LOS scenarios to green sturgeon spawning and egg incubation conditions in the Feather River.

Table 5C.5.2-197. Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River at Gridley Exceed the 64°F Threshold, May through September

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
EBC1					
May	32	19	10	4	2
June	93	89	79	64	48
July	100	100	100	90	69
August	100	100	91	80	62
September	69	54	28	7	2
EBC2					
May	32	19	11	4	2
June	93	89	79	64	51
July	100	100	100	89	68
August	100	100	93	78	60
September	41	26	12	6	2
EBC2_ELT					
May	60	36	22	12	6
June	96	96	91	86	73
July	100	100	100	100	85
August	100	100	100	95	81
September	51	40	28	20	9
ESO_ELT					
May	57	35	17	12	6
June	95	90	78	65	47
July	100	100	100	99	89
August	100	100	99	94	80
September	60	46	33	21	7

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
EBC2_LLT					
May	72	57	32	19	12
June	99	98	95	93	88
July	100	100	100	100	98
August	100	100	100	100	96
September	68	59	49	43	28
ESO_LLT					
May	67	47	31	19	11
June	98	89	83	73	60
July	100	100	100	100	98
August	100	100	100	100	96
September	86	70	58	43	33
HOS_ELT					
May	32	16	10	10	5
June	96	94	85	78	60
July	100	100	100	98	91
August	100	100	100	99	95
September	62	48	31	19	6
HOS_LLT					
May	53	35	19	11	9
June	95	93	84	74	69
July	100	100	100	100	98
August	100	100	100	100	100
September	80	69	62	48	37
LOS_ELT					
May	46	27	14	10	5
June	93	83	72	53	33
July	100	100	100	95	80
August	100	100	94	88	75
September	74	57	36	15	6
LOS_LLT					
May	62	40	22	16	10
June	96	90	79	68	60
July	100	100	100	99	93
August	100	100	100	96	94
September	95	86	73	59	40

Key:

	0%
	1–25%
	26–50%
	51–75%
	76–100%

Table 5C.5.2-198. Differences between EBC Scenarios and ESO, HOS, and LOS Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River at Gridley Exceed the 64°F Threshold, May through September

	Degrees Above Threshold				
Month	**>1.0**	**>2.0**	**>3.0**	**>4.0**	**>5.0**
EBC1 vs. ESO_ELT					
May	25 (77%)	16 (87%)	7 (75%)	9 (233%)	4 (150%)
June	2 (3%)	1 (1%)	-1 (-2%)	1 (2%)	-1 (-3%)
July	0 (0%)	0 (0%)	0 (0%)	9 (10%)	20 (29%)
August	0 (0%)	0 (0%)	7 (8%)	14 (17%)	19 (30%)
September	-9 (-13%)	-9 (-16%)	5 (17%)	14 (183%)	5 (200%)
EBC1 vs. ESO_LLT					
May	35 (108%)	28 (153%)	21 (213%)	15 (400%)	9 (350%)
June	5 (5%)	0 (0%)	4 (5%)	9 (13%)	12 (26%)
July	0 (0%)	0 (0%)	0 (0%)	10 (11%)	28 (41%)
August	0 (0%)	0 (0%)	9 (9%)	20 (25%)	35 (56%)
September	17 (25%)	16 (30%)	30 (104%)	36 (483%)	31 (1250%)
EBC2 vs. ESO_ELT					
May	25 (77%)	16 (87%)	6 (56%)	9 (233%)	4 (150%)
June	2 (3%)	1 (1%)	-1 (-2%)	1 (2%)	-4 (-7%)
July	0 (0%)	0 (0%)	0 (0%)	10 (11%)	21 (31%)
August	0 (0%)	0 (0%)	6 (7%)	16 (21%)	20 (33%)
September	20 (48%)	20 (76%)	21 (170%)	15 (240%)	5 (200%)
EBC2 vs. ESO_LLT					
May	35 (108%)	28 (153%)	20 (178%)	15 (400%)	9 (350%)
June	5 (5%)	0 (0%)	4 (5%)	9 (13%)	10 (20%)
July	0 (0%)	0 (0%)	0 (0%)	11 (13%)	30 (44%)
August	0 (0%)	0 (0%)	7 (8%)	22 (29%)	36 (59%)
September	46 (112%)	44 (171%)	46 (370%)	37 (600%)	31 (1250%)
EBC2_ELT vs. ESO_ELT					
May	-4 (-6%)	-1 (-3%)	-5 (-22%)	0 (0%)	0 (0%)
June	-1 (-1%)	-6 (-6%)	-14 (-15%)	-21 (-24%)	-26 (-36%)
July	0 (0%)	0 (0%)	0 (0%)	-1 (-1%)	4 (4%)
August	0 (0%)	0 (0%)	-1 (-1%)	-1 (-1%)	-1 (-2%)
September	10 (20%)	6 (16%)	5 (17%)	1 (6%)	-1 (-14%)
EBC2_LLT vs. ESO_LLT					
May	-5 (-7%)	-10 (-17%)	-1 (-4%)	0 (0%)	-1 (-10%)
June	-1 (-1%)	-9 (-9%)	-12 (-13%)	-20 (-21%)	-27 (-31%)
July	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
August	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
September	19 (27%)	11 (19%)	9 (18%)	0 (0%)	5 (17%)

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
EBC2_ELT vs. HOS_ELT					
May	-28 (-47%)	-20 (-55%)	-12 (-56%)	-2 (-20%)	-1 (-20%)
June	0 (0%)	-2 (-3%)	-6 (-7%)	-9 (-10%)	-12 (-17%)
July	0 (0%)	0 (0%)	0 (0%)	-2 (-2%)	6 (7%)
August	0 (0%)	0 (0%)	0 (0%)	4 (4%)	14 (17%)
September	11 (22%)	9 (22%)	2 (9%)	-1 (-6%)	-2 (-29%)
EBC2_LLT vs. HOS_LLT					
May	-19 (-26%)	-22 (-39%)	-14 (-42%)	-7 (-40%)	-4 (-30%)
June	-4 (-4%)	-5 (-5%)	-11 (-12%)	-19 (-20%)	-19 (-21%)
July	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
August	0 (0%)	0 (0%)	0 (0%)	0 (0%)	4 (4%)
September	12 (18%)	10 (17%)	12 (25%)	5 (11%)	9 (30%)
EBC2_ELT vs. LOS_ELT					
May	-15 (-24%)	-9 (-24%)	-9 (-39%)	-2 (-20%)	-1 (-20%)
June	-4 (-4%)	-14 (-14%)	-20 (-22%)	-33 (-39%)	-40 (-54%)
July	0 (0%)	0 (0%)	0 (0%)	-5 (-5%)	-5 (-6%)
August	0 (0%)	0 (0%)	-6 (-6%)	-7 (-8%)	-6 (-8%)
September	23 (46%)	17 (44%)	7 (26%)	-5 (-25%)	-2 (-29%)
EBC2_LLT vs. LOS_LLT					
May	-10 (-14%)	-17 (-30%)	-10 (-31%)	-2 (-13%)	-2 (-20%)
June	-2 (-3%)	-7 (-8%)	-16 (-17%)	-25 (-27%)	-27 (-31%)
July	0 (0%)	0 (0%)	0 (0%)	-1 (-1%)	-5 (-5%)
August	0 (0%)	0 (0%)	0 (0%)	-4 (-4%)	-2 (-3%)
September	27 (40%)	27 (46%)	23 (48%)	16 (37%)	11 (39%)

Degree-months for months that exceed the 64°F threshold were summed for all 82 years for erach model scenario and are presented in Table 5C.5.2-199; differences between EBC and ESO scenarios are presented in Table 5C.5.2-200. Spawning and egg incubation does not generally extend beyond June. During May and June, total exceedances above the threshold under ESO_ELT and ESO_LLT would be 6% to 23% degree-months lower (for all water-year types combined) than exceedances under EBC2_ELT and EBC2_LLT, respectively. Differences between EBC2 scenarios and HOS and LOS scenarios are presented in Table 5C.5.2-201. During May and June, total exceedances above the threshold under HOS and LOS scenarios would be 5% to 29% degree-months lower (for all water-year types combined) than exceedances under EBC2 scenarios. These results indicate that ESO, HOS, and LOS would provide small temperature-related benefits to green sturgeon spawning and egg incubation in the Feather River.

Combined, these analyses of NMFS threshold exceedances indicate that there would be small to moderate beneficial temperature-related effects of ESO, HOS, and LOS scenarios on spring-run Chinook salmon spawning and egg incubation conditions in the Feather River.

Table 5C.5.2-199. Total Degree-Months (°F-Months) by Month and Water-Year Type for Water Temperature Exceedances above 64°F in the Feather River at Gridley, May through September

Month	Water-Year Type	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
May	W	6	6	17	30	17	25	6	21	17	26
	AN	11	11	19	25	15	23	5	12	15	22
	BN	8	9	21	32	20	27	14	24	19	29
	D	14	14	31	43	30	42	31	37	31	40
	C	17	17	30	37	29	37	29	38	28	38
	All	56	57	118	167	111	154	84	132	110	155
June	W	75	75	119	142	87	93	115	136	84	102
	AN	51	52	68	80	45	51	65	76	44	51
	BN	65	66	83	97	46	65	69	75	41	63
	D	94	94	120	147	104	140	116	140	99	135
	C	56	57	76	95	77	92	76	93	75	92
	All	341	344	466	561	359	441	441	520	344	444
Jul	W	169	164	174	185	180	202	206	233	180	204
	AN	53	51	58	70	58	70	82	96	58	71
	BN	68	66	83	100	87	110	101	122	90	111
	D	86	86	112	130	132	173	144	180	123	166
	C	79	85	105	133	137	162	128	151	136	157
	All	455	452	532	618	594	717	662	783	587	710
Aug	W	179	172	176	196	184	225	222	256	189	224
	AN	45	46	53	67	60	82	75	96	59	81
	BN	70	67	88	102	95	120	106	137	90	116
	D	68	78	111	146	137	167	139	166	132	160
	C	85	91	111	135	103	134	105	135	103	132
	All	447	454	539	646	579	728	646	791	572	714
Sep	W	39	0	6	12	13	35	25	63	56	99
	AN	16	0	1	7	12	27	19	37	16	34
	BN	28	28	41	68	34	62	48	76	35	63
	D	28	25	39	80	41	76	37	76	42	74
	C	20	19	38	74	40	72	40	67	38	70
	All	131	72	125	241	140	272	168	318	187	340

Table 5C.5.2-200. Differences between EBC and ESO Scenarios in Total Degree-Months (°F-Months) by Month and Water-Year Type for Water Temperature Exceedances above 64°F in the Feather River at Gridley, May through September

Month	Water-Year Type	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
May	W	11 (183%)	19 (317%)	11 (183%)	19 (317%)	0 (0%)	-5 (-17%)
	AN	4 (36%)	12 (109%)	4 (36%)	12 (109%)	-4 (-21%)	-2 (-8%)
	BN	12 (150%)	19 (238%)	11 (122%)	18 (200%)	-1 (-5%)	-5 (-16%)
	D	16 (114%)	28 (200%)	16 (114%)	28 (200%)	-1 (-3%)	-1 (-2%)
	C	12 (71%)	20 (118%)	12 (71%)	20 (118%)	-1 (-3%)	0 (0%)
	All	55 (98%)	98 (175%)	54 (95%)	97 (170%)	-7 (-6%)	-13 (-8%)
June	W	12 (16%)	18 (24%)	12 (16%)	18 (24%)	-32 (-27%)	-49 (-35%)
	AN	-6 (-12%)	0 (0%)	-7 (-13%)	-1 (-2%)	-23 (-34%)	-29 (-36%)
	BN	-19 (-29%)	0 (0%)	-20 (-30%)	-1 (-2%)	-37 (-45%)	-32 (-33%)
	D	10 (11%)	46 (49%)	10 (11%)	46 (49%)	-16 (-13%)	-7 (-5%)
	C	21 (38%)	36 (64%)	20 (35%)	35 (61%)	1 (1%)	-3 (-3%)
	All	18 (5%)	100 (29%)	15 (4%)	97 (28%)	-107 (-23%)	-120 (-21%)
Jul	W	11 (7%)	33 (20%)	16 (10%)	38 (23%)	6 (3%)	17 (9%)
	AN	5 (9%)	17 (32%)	7 (14%)	19 (37%)	0 (0%)	0 (0%)
	BN	19 (28%)	42 (62%)	21 (32%)	44 (67%)	4 (5%)	10 (10%)
	D	46 (53%)	87 (101%)	46 (53%)	87 (101%)	20 (18%)	43 (33%)
	C	58 (73%)	83 (105%)	52 (61%)	77 (91%)	32 (30%)	29 (22%)
	All	139 (31%)	262 (58%)	142 (31%)	265 (59%)	62 (12%)	99 (16%)
Aug	W	5 (3%)	46 (26%)	12 (7%)	53 (31%)	8 (5%)	29 (15%)
	AN	15 (33%)	37 (82%)	14 (30%)	36 (78%)	7 (13%)	15 (22%)
	BN	25 (36%)	50 (71%)	28 (42%)	53 (79%)	7 (8%)	18 (18%)
	D	69 (101%)	99 (146%)	59 (76%)	89 (114%)	26 (23%)	21 (14%)
	C	18 (21%)	49 (58%)	12 (13%)	43 (47%)	-8 (-7%)	-1 (-1%)
	All	132 (30%)	281 (63%)	125 (28%)	274 (60%)	40 (7%)	82 (13%)
Sep	W	-26 (-67%)	-4 (-10%)	13 (NA)	35 (NA)	7 (117%)	23 (192%)
	AN	-4 (-25%)	11 (69%)	12 (NA)	27 (NA)	11 (1100%)	20 (286%)
	BN	6 (21%)	34 (121%)	6 (21%)	34 (121%)	-7 (-17%)	-6 (-9%)
	D	13 (46%)	48 (171%)	16 (64%)	51 (204%)	2 (5%)	-4 (-5%)
	C	20 (100%)	52 (260%)	21 (111%)	53 (279%)	2 (5%)	-2 (-3%)
	All	9 (7%)	141 (108%)	68 (94%)	200 (278%)	15 (12%)	31 (13%)

NA =Could not calculate because dividing by 0.

Table 5C.5.2-201. Differences between EBC2 and HOS and LOS Scenarios in Total Degree-Months (°F-Months) by Month and Water-Year Type for Water Temperature Exceedances above 64°F in the Feather River at Gridley, May through September

Month	Water-Year Type	EBC2_ELT vs. HOS_ELT	EBC2_LLT vs. HOS_LLT	EBC2_ELT vs. LOS_ELT	EBC2_LLT vs. LOS_LLT
May	W	-11 (-65%)	-9 (-30%)	0 (0%)	-4 (-13%)
	AN	-14 (-74%)	-13 (-52%)	-4 (-21%)	-3 (-12%)
	BN	-7 (-33%)	-8 (-25%)	-2 (-10%)	-3 (-9%)
	D	0 (0%)	-6 (-14%)	0 (0%)	-3 (-7%)
	C	-1 (-3%)	1 (3%)	-2 (-7%)	1 (3%)
	All	-34 (-29%)	-35 (-21%)	-8 (-7%)	-12 (-7%)
June	W	-4 (-3%)	-6 (-4%)	-35 (-29%)	-40 (-28%)
	AN	-3 (-4%)	-4 (-5%)	-24 (-35%)	-29 (-36%)
	BN	-14 (-17%)	-22 (-23%)	-42 (-51%)	-34 (-35%)
	D	-4 (-3%)	-7 (-5%)	-21 (-18%)	-12 (-8%)
	C	0 (0%)	-2 (-2%)	-1 (-1%)	-3 (-3%)
	All	-25 (-5%)	-41 (-7%)	-122 (-26%)	-117 (-21%)
Jul	W	32 (18%)	48 (26%)	6 (3%)	19 (10%)
	AN	24 (41%)	26 (37%)	0 (0%)	1 (1%)
	BN	18 (22%)	22 (22%)	7 (8%)	11 (11%)
	D	32 (29%)	50 (38%)	11 (10%)	36 (28%)
	C	23 (22%)	18 (14%)	31 (30%)	24 (18%)
	All	130 (24%)	165 (27%)	55 (10%)	92 (15%)
Aug	W	46 (26%)	60 (31%)	13 (7%)	28 (14%)
	AN	22 (42%)	29 (43%)	6 (11%)	14 (21%)
	BN	18 (20%)	35 (34%)	2 (2%)	14 (14%)
	D	28 (25%)	20 (14%)	21 (19%)	14 (10%)
	C	-6 (-5%)	0 (0%)	-8 (-7%)	-3 (-2%)
	All	107 (20%)	145 (22%)	33 (6%)	68 (11%)
Sep	W	19 (317%)	51 (425%)	50 (833%)	87 (725%)
	AN	18 (1800%)	30 (429%)	15 (1500%)	27 (386%)
	BN	7 (17%)	8 (12%)	-6 (-15%)	-5 (-7%)
	D	-2 (-5%)	-4 (-5%)	3 (8%)	-6 (-8%)
	C	2 (5%)	-7 (-9%)	0 (0%)	-4 (-5%)
	All	43 (34%)	77 (32%)	62 (50%)	99 (41%)

Seasonal Flows

Mean monthly flows in the Feather River high-flow channel at Thermalito Afterbay and at the confluence with the Sacramento River during March through June were reviewed to determine whether the ESO would have flow-related effects on green sturgeon spawning and egg incubation.

For the Feather River high-flow channel, average flows by month and water-year type for each model scenario are presented in Table 5C.5.2-123 and differences between pairs of model scenarios are presented in Table 5C.5.2-124. Monthly frequency of exceedance plots for flows are presented in Figure 5C.5.2-111 through Figure 5C.5.2-114. Flows under ESO_ELT and ESO_LLT during March through June would generally be greater than or similar to those under EBC2 ELT and EBC2_LLT, respectively, with few small to moderate flow reductions during some months and water-year types (up to 9% lower). Flows under HOS in the high-flow channel would generally be similar to flows under ESO during February through June (Table 5C.5.2-127, Table 5C.5.2-128). Flows under LOS would generally be similar to or greater than flows under ESO during February through May and lower than flows under ESO during June. However, despite the reduction in June flows under LOS relative to ESO, flows under LOS would still be greater than flows under EBC2.

For the Feather River at the confluence with the Sacramento River, average flows by month and water-year type for each model scenario are presented in Table 5C.5.2-185 and differences between pairs of model scenarios are presented in Table 5C.5.2-186. Monthly frequency of exceedance plots for flows for March through June are presented in Figure 5C.5.2-125 through Figure 5C.5.2-128. Flows under ESO_ELT and ESO_LLT during March through June would generally be greater than or similar to those under EBC2 ELT and EBC2_LLT, respectively, with few small exceptions (up to 9% lower). Flows under HOS at the Sacramento River confluence would generally be similar to flows under ESO during February through June (Table 5C.5.2-187, Table 5C.5.2-188). Flows under LOS would generally be similar to or greater than flows under ESO during February through May and lower than flows under ESO during June. However, despite the reduction in June flows under LOS relative to ESO, flows under LOS would still be greater than flows under EBC2.

Collectively, these results indicate that there would be small to moderate beneficial effects of the ESO, HOS, and LOS on green sturgeon spawning and egg incubation habitat in the Feather River that could lead to increased year class strength.

5C.5.2.4.6.2 Larvae

Water Temperature

Water temperatures were examined during the April through August larval green sturgeon rearing period in the Feather River at Honcut Creek and at the confluence with the Sacramento River.

Average predicted water temperatures by month and water-year type for each model scenario are presented for the Feather River at Honcut Creek in Table 5C.5.2-193 and differences between pairs of model scenarios are presented in Table 5C.5.2-194. Average predicted water temperatures by month and water-year type for each model scenario are presented for the Feather River at the confluence with the Sacramento River in Table 5C.5.2-189 and differences between pairs of model scenarios are presented in Table 5C.5.2-190. These results suggest that, at both locations, there would be very small (<4%) differences in mean water temperatures in all months and water-year types between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT during the April through August larval rearing period. Further, there would be no differences in April through August water temperatures between the ESO scenario and HOS and LOS scenarios at either location in the Feather River (Table 5C.5.2-191, Table 5C.5.2-192, Table 5C.5.2-195, Table 5C.5.2-196).

The water temperature threshold exceedance analysis for 64°F at Gridley discussed above for spawning and egg incubation was used to further determine whether there were water temperature related effects on green sturgeon larval rearing (Table 5C.5.2-197, Table 5C.5.2-198, Table 5C.5.2-199, Table 5C.5.2-200, and Table 5C.5.2-201).

The entire May through September period was considered for the analysis of green sturgeon larval rearing. Table 5C.5.2-197 reports the percent of months during the 82-year modeling period for each month that exceeded the 56°F threshold by 1°F to 5°F in 1°F increments for each scenario.

Table 5C.5.2-198 presents differences between model scenarios in these percent values. Results indicate that the percent of months exceeding the threshold would be similar (<5% difference on an absolute scale) between EBC2 and ESO scenarios in most months and degrees above the threshold. The percent of months exceeding the threshold would be up to 27% lower (absolute scale) under ESO compared to EBC2 for some criteria of degrees above the threshold during May and June and up to 19% higher (absolute scale) under ESO for some criteria of degrees above the threshold during September. The percent of months exceeding the threshold under HOS and LOS scenarios would be lower by up to 28% (absolute scale) than the percent under EBC2 scenarios during May and June, generally similar to the percent under EBC2 scenarios during July and August with some exceptions, and generally higher by up to 27% (absolute scale) than the percent under EBC2 scenarios during September with some exceptions. These results indicate that temperature condisions under ESO, HOS, and LOS scenarios would be better, similar, and worse than those under EBC2 scenarios depending on the month.

Degree-months for months that exceed the 64°F threshold were summed for all 82 years and are presented in Table 5C.5.2-199; differences between model scenarios are presented in Table 5C.5.2-200. These results indicate that there would be 7 to 120 degree-month (6% to 23%) reductions during May and June under ESO scenarios relative to EBC2 scenarios, but 15 to 99 degree-month (12% to 16%) increases during July through September. There would be 25 to 41 degree-month (5% to 7%) reductions during May and June under HOS scenarios relative to EBC2 scenarios, but 43 to 165 degree-month (27% to 34%) increases during July through September. There would be 8 to 122 degree-month (7% to 26%) reductions during May and June under LOS scenarios relative to EBC2 scenarios, but 33 to 99 degree-month (6% to 41%) increases during July through September. These results indicate that there would be both small beneficial and adverse effects to green sturgeon larval rearing in the Feather River. These results reflect the change under the ESO towards a more natural hydrograph in the Feather River that allows for flows to be higher earlier in the calendar year and lower later in the calendar year (Table 5C.5.2-123, Table 5C.5.2-124).

Combined, these analyses of NMFS threshold exceedances indicate that there would be small to moderate beneficial and adverse effects of the ESO on temperature-related green sturgeon larval rearing conditions in the Feather River. Beneficial effects would occur earlier in the period (May and June) and adverse effects would occur later in the period (August and September), compared to existing conditions. A potential outcome of this shift from warm temperatures earlier and cool temperatures later during the May to September period under EBC2 to cooler temperatures earlier and warmer temperatures later under ESO, HOS, and LOS scenarios is that eggs and larvae would survive better earlier under ESO, HOS, and LOS and be able to grow to a larger size that they may become more temperature tolerant or move to areas of cooler water. Under EBC2 scenarios, warmer temperatures in May and June may cause higher mortality or reduced condition of early life stages, reducing the potential to survive to a large enough size that they would be more temperature tolerant. Therefore, cooler temperatures earlier in the period may provide a benefit that outweighs negative effects of increased temepratures later in the period.

Regardless, all current applicable regulatory standards for the Feather River in the NMFS BiOp (National Marine Fisheries Service 2009) would be met under ESO, HOS, and LOS scenarios at the same frequency as are being met currently without BDCP. Therefore, regardless of these results, these scenarios would be protective of green sturgeon as defined by NMFS (2009).

5C.5.2.4.6.3 Juveniles

Water Temperature

Water temperatures were examined during the August through March juvenile green sturgeon rearing period in the Feather River at the confluence with the Sacramento River. Table 5C.5.2-189 presents predicted year-round mean monthly water temperatures by water-year type in the Feather River at the confluence with the Sacramento River. Table 5C.5.2-190 presents the differences and percent differences between pairs of model scenarios in mean monthly water temperatures by water-year type. These results indicate that there would be very small (<3%) differences in mean monthly water temperature in the Feather River at the confluence from August through March in all water-year types between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. Further, there would be no differences in August through March mean monthly water temperatures between the ESO scenario and HOS and LOS scenarios (Table 5C.5.2-191, Table 5C.5.2-192.

5C.5.2.4.6.4 Adults

Water Temperature

The analysis of water temperature-related effects of the ESO on spawning adult green sturgeon in the Feather River are presented as part of the Egg and Embryo section above. These results indicate that there would be small to moderate beneficial temperature-related effects of ESO, HOS, and LOS scenarios on green sturgeon spawners in the Feather River during the spawning and incubation period.

Seasonal Flows

The analysis of flow-related effects of the ESO on spawning adult green sturgeon in the Feather River are presented as part of the Egg and Embryo section above. These results indicate that there would be small to moderate beneficial effect of ESO, HOS, and LOS scenarios on the value and quantity of green sturgeon spawning and egg incubation habitat that could lead to increased year class strength in the Feather River.

5C.5.2.4.7 Lamprey

5C.5.2.4.7.1 Eggs

Water Temperature

Exact spawning locations of Pacific and river lamprey in the Feather River are not well known. Therefore, this analysis includes upstream (Fish Barrier Dam) and downstream (below Thermalito Afterbay) locations, which encompass the range in which the species are thought to spawn (Kurth pers. comm.). Pacific lamprey egg incubation in the Feather River occurs between January and August; river lamprey egg incubation occurs between February and June. Predicted average water temperatures by month and water-year type for the Feather River at the Fish Barrier Dam and below Thermalito Afterbay are presented in Table 5C.5.2-202 and Table 5C.5.2-151 respectively, and differences between model scenarios are presented in Table 5C.5.2-203 and Table 5C.5.2-152, respectively. These results indicate that there would be negligible differences in mean monthly water temperature in the Feather River at the Fish Barrier Dam and below Thermalito Afterbay in all months and water-year types between EBC2_ELT and ESO_ELT and between EBC2_LLT and

ESO_LLT. Further, there would be no differences in January through August mean monthly water temperatures between the ESO scenario and the HOS and LOS scenarios at either location (Table 5C.5.2-155, Table 5C.5.2-157, Table 5C.5.2-204, Table 5C.5.2-205). Based on these results, it was concluded that there would be no temperature-related effects of ESO, HOS, and LOS scenarios on Pacific or river lamprey egg incubation habitat and no further biological analyses are reported. Because this analysis uses water temperature model outputs based on CALSIM outputs, error has been propagated and the level of certainty of these results is moderate.

Table 5C.5.2-202. Mean Monthly Water Temperature (°F) in the Feather River at Fish Barrier Dam under EBC and ESO Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	48	48	49	51	49	51
	AN	47	48	49	50	49	50
	BN	48	47	49	51	49	51
	D	47	47	49	51	49	51
	C	48	47	49	51	49	51
	All	48	48	49	51	49	51
Feb	W	48	48	49	51	49	51
	AN	48	48	49	51	49	51
	BN	48	48	50	51	50	52
	D	49	49	50	52	50	52
	C	49	49	51	53	51	53
	All	48	48	50	51	50	51
Mar	W	49	49	50	51	50	51
	AN	49	49	50	51	50	51
	BN	50	50	51	53	51	53
	D	51	51	52	53	52	53
	C	51	51	52	54	53	54
	All	50	50	51	52	51	53
Apr	W	51	51	51	52	51	52
	AN	51	51	52	53	52	53
	BN	52	52	53	54	53	54
	D	52	52	53	54	53	54
	C	52	51	53	54	53	54
	All	51	51	52	53	52	53
May	W	55	55	55	56	55	55
	AN	56	56	56	56	56	56
	BN	56	56	56	56	56	56
	D	56	56	56	56	56	56
	C	56	56	56	57	56	57
	All	55	56	56	56	56	56
Jun	W	57	57	58	58	57	57
	AN	58	58	58	58	58	58
	BN	58	58	58	58	57	58
	D	58	58	58	58	58	58
	C	58	58	58	59	58	59
	All	58	58	58	58	58	58

Month	Water-Year Type[a]	Scenario[b] EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jul	W	61	61	61	61	61	61
	AN	61	61	61	61	61	61
	BN	61	61	61	61	61	61
	D	61	61	61	61	61	62
	C	61	62	62	62	63	63
	All	61	61	61	61	61	62
Aug	W	61	61	61	61	61	61
	AN	60	60	60	60	60	61
	BN	60	60	60	60	60	61
	D	60	60	61	62	61	61
	C	62	62	63	64	62	63
	All	61	61	61	61	61	61
Sep	W	56	54	55	55	55	56
	AN	56	55	55	55	55	56
	BN	56	56	56	57	57	58
	D	56	56	57	61	57	59
	C	58	57	59	63	58	63
	All	56	55	56	58	56	58
Oct	W	54	54	54	58	54	57
	AN	55	54	55	58	56	58
	BN	54	54	55	58	55	58
	D	54	54	55	59	55	60
	C	54	54	55	58	55	58
	All	54	54	55	58	55	58
Nov	W	52	52	53	58	53	58
	AN	53	53	54	58	54	57
	BN	53	53	54	58	54	58
	D	52	53	54	59	55	59
	C	53	53	54	58	54	58
	All	53	53	54	58	54	58
Dec	W	49	49	51	53	51	53
	AN	49	49	51	55	51	54
	BN	49	49	51	54	51	54
	D	49	49	51	54	51	54
	C	49	49	51	54	51	54
	All	49	49	51	54	51	54

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of scenarios.

Table 5C.5.2-203. Differences[a] between EBC and ESO Scenarios in Mean Monthly Water Temperature (°F) in the Feather River at Fish Barrier Dam

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	1 (2.7%)	3 (5.9%)	1 (2.7%)	3 (5.9%)	0 (0%)	0.04 (0.1%)
	AN	1 (3.1%)	3 (6.5%)	1 (2.7%)	3 (6.2%)	-0.2 (-0.3%)	0.04 (0.1%)
	BN	1 (2.6%)	3 (6.4%)	1 (3%)	3 (6.8%)	-0.2 (-0.3%)	0.02 (0%)
	D	2 (3.4%)	4 (7.4%)	2 (3.3%)	3 (7.3%)	-0.2 (-0.3%)	0.1 (0.2%)
	C	2 (3.8%)	4 (8.1%)	2 (4%)	4 (8.3%)	0.1 (0.2%)	0.03 (0.1%)
	All	1 (3%)	3 (6.7%)	1 (3.1%)	3 (6.8%)	-0.1 (-0.2%)	0.05 (0.1%)
Feb	W	1 (2.4%)	3 (5.3%)	1 (2.6%)	3 (5.6%)	0.04 (0.1%)	-0.05 (-0.1%)
	AN	1 (2.7%)	3 (5.4%)	1 (2.7%)	3 (5.4%)	0 (0%)	0.1 (0.1%)
	BN	1 (2.9%)	3 (6.5%)	1 (2.7%)	3 (6.3%)	-0.1 (-0.2%)	0.2 (0.3%)
	D	1 (3%)	3 (6.2%)	1 (2.9%)	3 (6%)	0 (0%)	0.1 (0.2%)
	C	2 (3.4%)	3 (7.1%)	2 (3.4%)	3 (7%)	-0.04 (-0.1%)	0 (0%)
	All	1 (2.8%)	3 (6%)	1 (2.8%)	3 (6%)	0 (0%)	0.04 (0.1%)
Mar	W	1 (2.1%)	3 (5.3%)	1 (2.3%)	3 (5.4%)	0.1 (0.1%)	0.1 (0.2%)
	AN	1 (1.8%)	2 (4.7%)	1 (1.9%)	2 (4.7%)	-0.1 (-0.1%)	0.1 (0.1%)
	BN	2 (3.5%)	4 (7.2%)	1.3 (2.5%)	3 (6.2%)	0.1 (0.2%)	0.3 (0.6%)
	D	1.2 (2.3%)	3 (4.9%)	1 (2.1%)	2 (4.7%)	-0.1 (-0.2%)	0.2 (0.3%)
	C	1 (2.8%)	3 (6%)	1 (2.6%)	3 (5.7%)	0.3 (0.5%)	-0.1 (-0.1%)
	All	1 (2.5%)	3 (5.6%)	1 (2.3%)	3 (5.3%)	0.04 (0.1%)	0.1 (0.2%)
Apr	W	1 (1.1%)	2 (3.7%)	1 (1.1%)	2 (3.7%)	0.05 (0.1%)	0.03 (0.1%)
	AN	1 (1.2%)	2 (3.4%)	1 (1.2%)	2 (3.5%)	0.1 (0.1%)	0.05 (0.1%)
	BN	0 (0.9%)	2 (3.4%)	0 (0.8%)	2 (3.2%)	-0.04 (-0.1%)	0.1 (0.1%)
	D	1 (1.1%)	2 (3.3%)	1 (1.2%)	2 (3.4%)	-0.1 (-0.2%)	-0.2 (-0.4%)
	C	1 (2%)	2 (4.8%)	1 (2.1%)	3 (4.9%)	-0.1 (-0.1%)	-0.1 (-0.1%)
	All	1 (1.2%)	2 (3.7%)	1 (1.3%)	2 (3.7%)	0 (0%)	-0.03 (-0.1%)
May	W	0 (0.6%)	1 (1.1%)	0 (0.6%)	1 (1.1%)	0 (0%)	-0.1 (-0.2%)
	AN	0 (0.2%)	0 (0.4%)	0 (0.2%)	0 (0.4%)	-0.3 (-0.5%)	-0.3 (-0.5%)
	BN	0 (0.4%)	0 (0%)	0 (0.3%)	0 (0%)	-0.1 (-0.1%)	-0.3 (-0.6%)
	D	0 (0.3%)	0 (0.4%)	0 (0.3%)	0 (0.4%)	0 (0%)	-0.04 (-0.1%)
	C	0 (0.8%)	1 (1.3%)	0 (0.7%)	1 (1.2%)	0.1 (0.2%)	-0.1 (-0.2%)
	All	0 (0.5%)	0 (0.7%)	0 (0.4%)	0 (0.7%)	-0.04 (-0.1%)	-0.2 (-0.3%)
Jun	W	0 (0.2%)	0 (0.2%)	0 (0.3%)	0 (0.2%)	-0.4 (-0.7%)	-0.3 (-0.6%)
	AN	0 (-0.3%)	0 (-0.3%)	0 (-0.3%)	0 (-0.3%)	-0.5 (-0.8%)	-1 (-0.9%)
	BN	-1 (-0.9%)	0 (-0.5%)	-1 (-0.9%)	0 (-0.5%)	-1 (-1.2%)	-1 (-1%)
	D	0 (0%)	0 (0.8%)	0.1 (0.2%)	1 (0.9%)	-0.2 (-0.3%)	-0.1 (-0.1%)
	C	0 (0.7%)	1 (1.9%)	0 (0.8%)	1 (1.9%)	0.1 (0.2%)	-0.1 (-0.2%)
	All	0 (0%)	0 (0.4%)	0 (0%)	0 (0.4%)	-0.3 (-0.6%)	0 (-0.5%)
Jul	W	0 (0.2%)	0 (0.4%)	0 (0.2%)	0 (0.5%)	0.1 (0.1%)	0 (0.2%)
	AN	0.1 (0.1%)	0 (0.5%)	0.2 (0.3%)	0 (0.6%)	0 (0%)	0 (0%)
	BN	0 (0.4%)	1 (1%)	0 (0.5%)	1 (1%)	0.1 (0.1%)	0.1 (0.2%)
	D	1 (0.9%)	1 (1.8%)	1 (0.9%)	1 (1.8%)	0.3 (0.5%)	1 (0.9%)
	C	2 (2.5%)	2 (4%)	1 (1.5%)	2 (2.9%)	1 (1.1%)	1 (1.6%)
	All	0 (0.7%)	1 (1.4%)	0 (0.6%)	1 (1.3%)	0.2 (0.3%)	0.3 (0.6%)

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Aug	W	-0.1 (-0.1%)	0 (0.2%)	0 (0.2%)	0 (0.5%)	0.3 (0.5%)	0.4 (0.7%)
	AN	0.2 (0.3%)	1 (0.9%)	0.3 (0.5%)	1 (1.2%)	0.2 (0.3%)	0.4 (0.6%)
	BN	0 (0.7%)	1 (1.6%)	0 (0.7%)	1 (1.6%)	0.2 (0.2%)	0.4 (0.7%)
	D	1 (1.6%)	2 (2.6%)	1 (1%)	1 (1.9%)	0.2 (0.3%)	-0.3 (-0.5%)
	C	0 (0.5%)	2 (2.4%)	0 (0.4%)	1 (2.4%)	-1 (-1.4%)	-1 (-1.4%)
	All	0 (0.5%)	1 (1.4%)	0 (0.5%)	1 (1.4%)	0.1 (0.1%)	0.1 (0.1%)
Sep	W	-1 (-2%)	0 (-0.4%)	0 (0.7%)	1 (2.3%)	0.2 (0.4%)	0.4 (0.7%)
	AN	-1 (-1.4%)	0 (-0.2%)	1 (0.9%)	1 (2.2%)	0.3 (0.6%)	0.4 (0.7%)
	BN	1 (1.4%)	2 (3.9%)	1 (1.7%)	2 (4.2%)	1 (1.5%)	0.7 (1.2%)
	D	2 (2.9%)	3 (6.1%)	1 (2.6%)	3 (5.8%)	0.1 (0.2%)	-2 (-2.5%)
	C	0 (0.8%)	5 (8%)	1 (2.1%)	5 (9.4%)	-0.3 (-0.5%)	-1 (-1.2%)
	All	0 (0.2%)	2 (3.1%)	1 (1.5%)	3 (4.5%)	0.2 (0.4%)	-0.2 (-0.3%)
Oct	W	1 (1%)	4 (7.2%)	0 (0.9%)	4 (7%)	-0.1 (-0.2%)	-1 (-1.2%)
	AN	1 (1.1%)	3 (5.3%)	1.1 (2%)	3 (6.3%)	0.1 (0.1%)	-0.5 (-0.8%)
	BN	1 (1.5%)	4 (7.3%)	0 (0.9%)	4 (6.6%)	-0.2 (-0.4%)	-0.4 (-0.6%)
	D	1 (1.6%)	6 (11%)	0.9 (1.6%)	6 (11.1%)	-1 (-1.5%)	0.2 (0.3%)
	C	1 (1.2%)	4 (7.2%)	1 (1.2%)	4 (7.2%)	-0.5 (-0.8%)	0.1 (0.2%)
	All	1 (1.3%)	4 (7.8%)	1 (1.3%)	4 (7.8%)	-0.3 (-0.6%)	-0.3 (-0.5%)
Nov	W	1 (2%)	6 (10.9%)	1 (2%)	6 (10.9%)	0 (0%)	-0.2 (-0.3%)
	AN	1 (2.4%)	4 (8.1%)	1 (2.2%)	4 (7.9%)	0.1 (0.1%)	-0.6 (-1.1%)
	BN	1 (1.7%)	5 (10.1%)	1 (2%)	5 (10.4%)	-0.1 (-0.1%)	-0.1 (-0.2%)
	D	2 (4.2%)	6 (11.5%)	2 (4.1%)	6 (11.5%)	0.3 (0.6%)	-0.2 (-0.4%)
	C	1 (1.8%)	6 (10.5%)	1 (1.8%)	5 (10.4%)	-0.1 (-0.2%)	0.3 (0.5%)
	All	1 (2.5%)	6 (10.5%)	1 (2.5%)	5 (10.5%)	0.1 (0.1%)	-0.2 (-0.3%)
Dec	W	2 (3.6%)	4 (8.9%)	2 (3.8%)	4 (9.1%)	-0.1 (-0.2%)	-0.1 (-0.2%)
	AN	2 (3.7%)	5 (10.8%)	2 (3.5%)	5 (10.5%)	-0.2 (-0.3%)	-0.3 (-0.6%)
	BN	3 (5.2%)	5 (11.2%)	2 (4.8%)	5 (10.8%)	0.4 (0.9%)	-0.1 (-0.2%)
	D	2.5 (5%)	5 (10.4%)	2 (4.9%)	5 (10.2%)	0.03 (0.1%)	0 (0%)
	C	2 (4.5%)	5 (10%)	2 (4.5%)	5 (10.1%)	1 (1.1%)	0.2 (0.3%)
	All	2 (4.3%)	5 (10%)	2 (4.3%)	5 (10%)	0.1 (0.2%)	-0.1 (-0.2%)

[a] Positive values indicate higher temperature under ESO than under EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of scenarios.

Table 5C.5.2-204. Mean Monthly Water Temperature (°F) in the Feather River at the Fish Barrier Dam for ESO, HOS, and LOS Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	49	51	49	51	49	51
	AN	49	50	49	50	49	51
	BN	49	51	49	51	49	51
	D	49	51	49	51	49	51
	C	49	51	49	51	50	51
	All	49	51	49	51	49	51
Feb	W	49	51	49	51	49	51
	AN	49	51	49	51	49	51
	BN	50	52	50	51	50	51
	D	50	52	50	52	50	52
	C	51	53	51	53	51	53
	All	50	51	50	51	50	51
Mar	W	50	51	50	51	50	51
	AN	50	51	50	51	50	51
	BN	51	53	51	53	51	53
	D	52	53	52	54	52	53
	C	53	54	53	54	53	54
	All	51	53	51	53	51	53
Apr	W	51	52	51	52	51	53
	AN	52	53	51	53	52	53
	BN	53	54	52	53	53	54
	D	53	54	53	54	53	54
	C	53	54	53	54	53	54
	All	52	53	52	53	52	53
May	W	55	55	55	55	55	55
	AN	56	56	55	55	56	56
	BN	56	56	56	56	56	56
	D	56	56	56	56	56	56
	C	56	57	56	57	56	57
	All	56	56	55	56	56	56
Jun	W	57	57	58	58	57	58
	AN	58	58	58	58	58	58
	BN	57	58	58	58	57	58
	D	58	58	58	58	58	58
	C	58	59	58	59	58	59
	All	58	58	58	58	58	58
Jul	W	61	61	62	62	61	62
	AN	61	61	61	62	61	61
	BN	61	61	61	62	61	61
	D	61	62	62	62	61	62
	C	63	63	62	63	63	63
	All	61	62	62	62	61	62

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Aug	W	61	61	61	62	61	61
	AN	60	61	61	62	60	61
	BN	60	61	61	62	60	61
	D	61	61	61	61	61	61
	C	62	63	61	62	62	63
	All	61	61	61	62	61	61
Sep	W	55	56	56	57	57	57
	AN	55	56	56	58	56	57
	BN	57	58	59	61	57	58
	D	57	59	57	58	57	58
	C	58	63	57	59	59	62
	All	56	58	57	58	57	58
Oct	W	54	57	55	58	54	56
	AN	56	58	56	60	55	57
	BN	55	58	56	59	55	57
	D	55	60	57	59	54	57
	C	55	58	54	55	54	57
	All	55	58	56	58	55	57
Nov	W	53	58	54	57	53	56
	AN	54	57	55	59	54	56
	BN	54	58	55	57	53	57
	D	55	59	55	58	54	57
	C	54	58	53	56	53	58
	All	54	58	54	57	53	57
Dec	W	51	53	51	53	50	53
	AN	51	54	51	54	51	54
	BN	51	54	51	54	50	54
	D	51	54	51	54	51	53
	C	51	54	50	54	51	54
	All	51	54	51	54	51	53

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of scenarios.

Table 5C.5.2-205. Differences[a] between the ESO Scenarios and HOS and LOS Scenarios in Mean Monthly Water Temperature (°F) in the Feather River at the Fish Barrier Dam

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	0.1 (0.2%)	0.1 (0.1%)	0 (0%)	0.2 (0.3%)
	AN	0.2 (0.4%)	-0.1 (-0.1%)	-0.1 (-0.3%)	0.2 (0.3%)
	BN	0 (0%)	-0.1 (-0.1%)	-0.1 (-0.2%)	-0.1 (-0.2%)
	D	0.1 (0.2%)	0 (0%)	-0.1 (-0.2%)	0.2 (0.3%)
	C	-0.2 (-0.4%)	0.1 (0.2%)	0.2 (0.5%)	0 (0%)
	All	0 (0.1%)	0 (0%)	0 (0%)	0.1 (0.2%)
Feb	W	0 (0.1%)	0.1 (0.2%)	0.1 (0.1%)	0.3 (0.5%)
	AN	0.1 (0.2%)	-0.1 (-0.2%)	0.1 (0.1%)	0.1 (0.3%)
	BN	0.1 (0.3%)	-0.1 (-0.2%)	0.1 (0.1%)	-0.2 (-0.3%)
	D	-0.05 (-0.1%)	0 (0%)	0.1 (0.1%)	0.1 (0.3%)
	C	0 (0%)	0.3 (0.5%)	0.1 (0.2%)	0 (0%)
	All	0.04 (0.1%)	0.03 (0.1%)	0.1 (0.1%)	0.1 (0.2%)
Mar	W	0 (0%)	0.03 (0.1%)	0.03 (0.1%)	0.2 (0.4%)
	AN	0.2 (0.3%)	0.05 (0.1%)	0.04 (0.1%)	0 (0%)
	BN	-0.3 (-0.6%)	-0.2 (-0.4%)	-0.2 (-0.5%)	-0.2 (-0.3%)
	D	-0.1 (-0.2%)	0.1 (0.1%)	-0.1 (-0.2%)	0.05 (0.1%)
	C	0.1 (0.2%)	0.2 (0.3%)	-0.03 (-0.1%)	-0.1 (-0.2%)
	All	-0.03 (-0.1%)	0 (0%)	-0.1 (-0.1%)	0 (0%)
Apr	W	-0.3 (-0.5%)	-0.2 (-0.4%)	0 (0%)	0.1 (0.3%)
	AN	-1 (-1.2%)	-1 (-1.3%)	0 (0%)	0.1 (0.1%)
	BN	-1 (-1.3%)	-1 (-1%)	0 (0%)	0 (0%)
	D	0 (0%)	0.1 (0.2%)	0.1 (0.1%)	0.1 (0.1%)
	C	0.2 (0.4%)	0.4 (0.8%)	-0.03 (-0.1%)	0.1 (0.2%)
	All	-0.3 (-0.5%)	-0.2 (-0.3%)	0 (0%)	0.1 (0.2%)
May	W	-0.5 (-0.8%)	-0.4 (-0.6%)	0 (0%)	0 (0%)
	AN	-1 (-1.3%)	-1 (-1%)	0.1 (0.2%)	0 (0%)
	BN	-1 (-1.1%)	-0.05 (-0.1%)	0 (0%)	0.1 (0.1%)
	D	0 (0%)	-0.04 (-0.1%)	0 (0%)	0 (0%)
	C	-0.03 (-0.1%)	0.2 (0.3%)	0.03 (0.1%)	0.2 (0.3%)
	All	-0.4 (-0.7%)	-0.2 (-0.3%)	0 (0%)	0.1 (0.1%)
Jun	W	1 (1.1%)	1 (1%)	0 (0%)	0.1 (0.1%)
	AN	1 (0.9%)	1 (1.2%)	0 (0%)	0 (0%)
	BN	1 (0.9%)	0.2 (0.4%)	-0.1 (-0.3%)	-0.04 (-0.1%)
	D	0.2 (0.3%)	0.1 (0.1%)	-0.1 (-0.1%)	0 (0%)
	C	0 (0.1%)	-0.4 (-0.6%)	-0.05 (-0.1%)	0 (0%)
	All	0.4 (0.7%)	0.3 (0.5%)	-0.04 (-0.1%)	0 (0%)
Jul	W	0.2 (0.4%)	0.3 (0.4%)	0 (0%)	0.05 (0.1%)
	AN	1 (0.9%)	1 (0.9%)	0 (0%)	0 (0%)
	BN	0.2 (0.4%)	0.3 (0.5%)	0 (0%)	0 (0%)
	D	0.2 (0.4%)	0.3 (0.4%)	-0.1 (-0.1%)	-0.1 (-0.2%)
	C	-0.2 (-0.3%)	-0.4 (-0.6%)	0.4 (0.6%)	-0.1 (-0.2%)
	All	0.2 (0.3%)	0.2 (0.3%)	0.1 (0.1%)	0 (0%)

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	1 (0.9%)	1 (1.4%)	0.1 (0.1%)	0 (0%)
	AN	1 (1.3%)	1 (1.9%)	0 (0%)	0.04 (0.1%)
	BN	1 (0.9%)	2 (2.5%)	-0.05 (-0.1%)	-0.2 (-0.4%)
	D	0.4 (0.6%)	0.1 (0.1%)	-0.1 (-0.2%)	-0.3 (-0.6%)
	C	-1 (-1.6%)	-1 (-1.8%)	0 (0%)	0.2 (0.3%)
	All	0.3 (0.5%)	1 (0.9%)	0 (0%)	-0.1 (-0.1%)
Sep	W	1 (1.4%)	1 (2.5%)	2 (3.5%)	2 (2.8%)
	AN	1 (2.3%)	2 (4.4%)	1 (2.5%)	1 (2.3%)
	BN	2 (3.8%)	3 (5.2%)	0 (0%)	-0.1 (-0.2%)
	D	-0.4 (-0.6%)	-1 (-2.2%)	-1 (-1.1%)	-1 (-1.9%)
	C	-2 (-2.8%)	-3 (-5.2%)	0.1 (0.2%)	-1 (-1.7%)
	All	0.5 (0.8%)	1 (0.9%)	1 (1.2%)	0.3 (0.4%)
Oct	W	1 (2.5%)	1 (1.6%)	-0.04 (-0.1%)	-2 (-2.9%)
	AN	1 (1.5%)	3 (4.4%)	-0.4 (-0.7%)	-1 (-1.1%)
	BN	1 (2.1%)	1 (1.9%)	0 (0%)	-1 (-1.5%)
	D	2 (3.5%)	-0.5 (-0.8%)	-0.2 (-0.3%)	-2 (-3.9%)
	C	-1 (-0.9%)	-3 (-5%)	-0.5 (-0.8%)	-1 (-1.8%)
	All	1 (2%)	0.3 (0.5%)	-0.2 (-0.3%)	-1 (-2.5%)
Nov	W	1 (1.3%)	-1 (-1.1%)	-0.4 (-0.8%)	-2 (-3.5%)
	AN	1 (1%)	1 (1.9%)	-0.2 (-0.3%)	-1 (-1.7%)
	BN	1 (1.7%)	-1 (-1.2%)	-0.5 (-0.9%)	-2 (-2.8%)
	D	0.03 (0.1%)	-1 (-1.1%)	-1 (-1.9%)	-1 (-2.1%)
	C	-1 (-1.6%)	-2 (-4.3%)	-0.3 (-0.5%)	-1 (-1%)
	All	0.3 (0.6%)	-1 (-1.2%)	-1 (-1%)	-1 (-2.4%)
Dec	W	0.1 (0.1%)	0.2 (0.4%)	-0.3 (-0.6%)	-0.2 (-0.5%)
	AN	0.5 (0.9%)	-0.2 (-0.4%)	-0.3 (-0.5%)	-1 (-1.2%)
	BN	-0.4 (-0.8%)	-0.3 (-0.5%)	-1 (-1.7%)	-0.4 (-0.7%)
	D	-0.2 (-0.4%)	0.1 (0.2%)	-1 (-1.4%)	-1 (-1.1%)
	C	-1 (-2.5%)	-0.5 (-0.8%)	-0.3 (-0.6%)	0.1 (0.2%)
	All	-0.2 (-0.4%)	-0.05 (-0.1%)	-0.5 (-1%)	-0.3 (-0.6%)

[a] Positive values indicate higher temperature under HOS or LOS than under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of scenarios.

Redd Dewatering

To determine the effects of the ESO on redd dewatering risk to Pacific and river lamprey in the Feather River, the number and frequency of redd "cohorts" experiencing a month-over-month (from one month to the next) decrease in flow of greater than 50%, which is assumed here to represent a redd dewatering event, at Thermalito Afterbay was determined from CALSIM model outputs. Small-scale spawning location suitability characteristics (e.g., depth, velocity, and substrate) is not adequately for lamprey described to enable a more formal analysis, such as a weighted usable area analysis. Therefore, the change in month-over-month flows was used as a surrogate a month-over-month flow reduction of 50% was chosen as a best professional estimate of conditions in which redd dewatering is expected to occur, but this value does not estimate empirically-derived redd dewatering events. A "cohort" of eggs was assumed to be "born" every month during either January through August for Pacific lamprey or February through June for river lamprey.

Results of the dewatering risk for Pacific lamprey are presented in Table 5C.5.2-91 and differences between pairs of model scenarios in redd dewatering risk are presented in Table 5C.5.2-92. The total predicted number of redd cohorts between January and August experiencing a month-over-month decrease in flow of greater than 50% in the Feather River at Thermalito Afterbay under the ESO_ELT and ESO_LLT would be 10% and 11% greater than the number under EBC2_ELT and EBC2_LLT, respectively. This increase corresponds to an increase of only 11 and 12 cohorts for the ELT and LLT comparisons, respectively, which represents <2% of total cohorts. Therefore, this increased exposure would not affect Pacific lamprey in a biologically meaningful way.

Results of the dewatering risk for river lamprey are presented in Table 5C.5.2-93 and differences between pairs of model scenarios in redd dewatering risk are presented in Table 5C.5.2-94. The total number of redd cohorts that would experience a 50% month-over-month flow decrease would be similar between the EBC2 and ESO in the Feather River at Thermalito Afterbay in both the ELT and LLT. These results indicate that there would be no effect of the ESO on river lamprey redd dewatering in the Feather River.

Due to differences in flows in the Feather River between the ESO scenario and HOS and LOS scenarios, the redd dewatering analysis was conducted for HOS and LOS scenarios. Results are presented in Table 5C.5.2-206 and differences between pairs of model scenarios are presented in Table 5C.5.2-207. For Pacific lamprey, dewatering risk would be minorly higher under HOS and moderately higher under LOS than under ESO. For river lamprey, dewatering risk would be moderately higher under HOS and minorly higher under LOS than under ESO. Because neither the exact locations of Pacific and river lamprey redds nor flow-WUA relationships for Pacific and river lamprey were used in this analysis, these results represent a relative estimate of redd dewatering among model scenarios. Therefore, there is low certainty in these conclusions.

Table 5C.5.2-206. Dewatering Risk[a] of Lamprey Redd Cohorts in the Feather River at Thermalito Afterbay for ESO, HOS, and LOS Scenarios

Lamprey Species	Metric	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Pacific[c]	Number	124	120	136	123	163	149
	Percent of total	19%	18%	21%	19%	25%	23%
River[d]	Number	65	60	73	74	69	63
	Percent of total	16%	15%	18%	18%	17%	15%

[a] Predicted number of and percent of total Pacific lamprey redd cohorts experiencing a month-over-month reduction in flows of greater than 50% during January to August for each model scenario.
[b] See Table 5C.0-1 for definitions of scenarios.
[c] n = 656 cohorts
[d] n = 410 cohorts

Table 5C.5.2-207. Differences[a] between ESO Scenarios and HOS and LOS Scenarios in Dewatering Risk of Lamprey Redd Cohorts in the Feather River at Thermalito Afterbay[b]

Lamprey Species	Scenarios[b]			
	ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Pacific	12 (10%)	3 (3%)	39 (31%)	29 (24%)
River	8 (12%)	14 (23%)	4 (6%)	3 (5%)

[a] Positive values indicate a greater dewater risk under the HOS or LOS than under the ESO.
[b] See Table 5C.0-1 for definitions of scenarios.

5C.5.2.4.7.2 Ammocoete

Water Temperature

For Pacific lamprey, water temperatures above 22°C (71.6°F) may cause significant death (~50%) or deformation of eggs and ammocoetes (Meeuwig et al. 2005). For river lamprey, no specific water temperature thresholds for ammocoetes have been established. Therefore, either 71.6°F, the Pacific lamprey ammocoete threshold, or 77°F, the river lamprey egg temperature threshold could be used to determine effects. As indicated above, there are negligible differences in water temperatures between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT in the Feather River at the Fish Barrier Dam or below Thermalito Afterbay regardless of month and water-year type (Table 5C.5.2-151, Table 5C.5.2-152, Table 5C.5.2-202, Table 5C.5.2-203). Further, there would generally be no differences in water temperatures between the ESO scenario and HOS and LOS scenarios at the Fish Barrier Dam and below Thermalito Afterbay (Table 5C.5.2-155, Table 5C.5.2-157, Table 5C.5.2-204, Table 5C.5.2-205). Therefore, it was concluded with low certainty that there are no temperature-related effects of ESO, HOS, and LOS scenarios on Pacific or river lamprey ammocoetes in the Feather River. As a result, no further temperature analyses were conducted for lamprey ammocoetes in the Feather River.

Stranding

To determine the effects of the ESO on ammocoete stranding risk to Pacific and river lamprey in the Feather River, the number and frequency of ammocoete "cohorts" experiencing a month-over-month decrease in flow ranging from greater than 50% to greater than 90% at Thermalito Afterbay was determined from CALSIM model outputs. The range of flow reductions was 50–90% (in 5% increments) and included the range in which model scenarios were distinguishable and indistinguishable from one another. For Pacific lamprey, a "cohort" of ammocoetes was assumed to be "born" every month during their spawning period (January-August) and spend five years rearing upstream. For river lamprey, cohorts were assumed to be born every month during February through June and spend five years rearing upstream. A cohort was considered "stranded" if at least one month-over-month flow reduction was greater than the each flow reduction at any time during the seven-year (for Pacific lamprey) or five-year rearing period (for river lamprey).

The number of Pacific lamprey ammocoete cohorts that may be stranded by month-over-month flow reductions in the Feather River at Thermalito Afterbay is presented in Figure 5C.5.2-135 and differences between model scenarios are presented in Table 5C.5.2-208. Differences in the number of Pacific lamprey ammocoetes exposed to flow reductions between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT are predicted to generally be negligible for all flow reductions examined, except in the ELT at the higher range of flow reductions. For the 85% and 90% flow reductions, ammocoete stranding risk would be 30% and 64% lower under ESO_ELT relative to EBC2_ELT. For the 80%, 85%, and 90% flow reductions, ammocoete stranding risk would be 10%, 35%, and 6% lower under ESO_LLT relative to EBC2_LLT. These results indicate that there are generally no effects of flow reductions under the ESO on Pacific lamprey stranding risk at the lower flow reduction range and benefits of the ESO at higher flow reduction range.

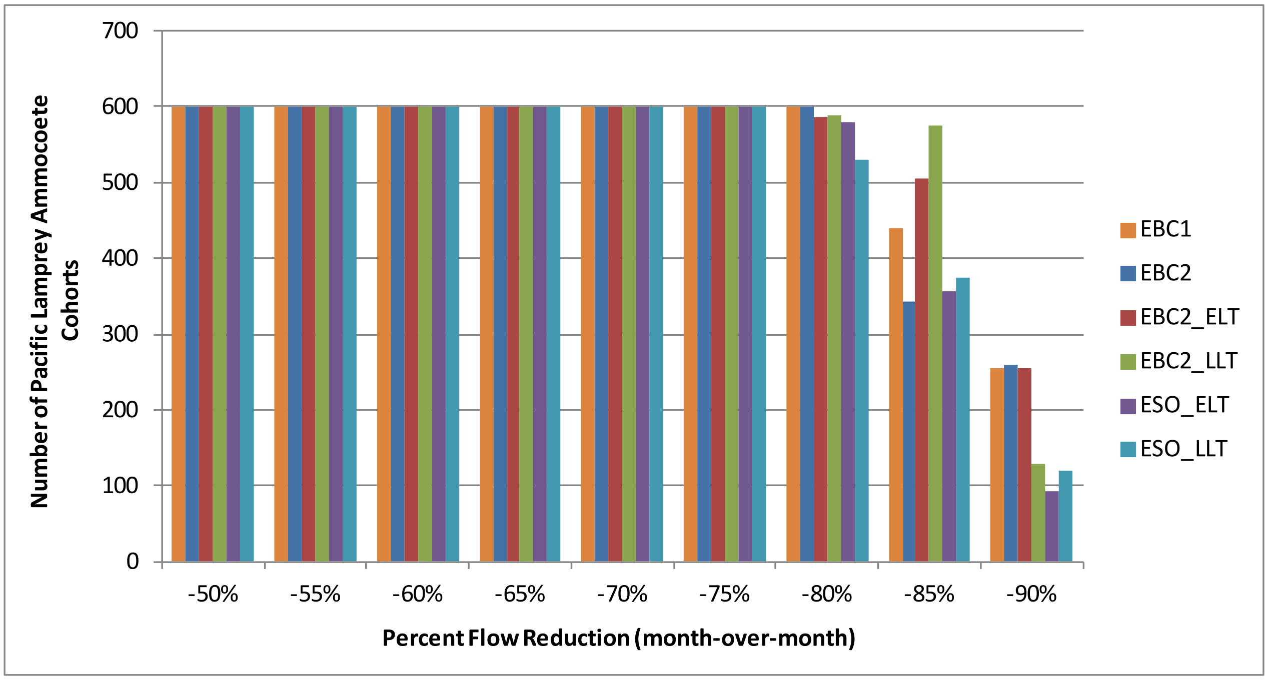


Figure 5C.5.2-135. Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions of 50% to 90%, Feather River at Thermalito Afterbay, under EBC and ESO Scenarios

Table 5C.5.2-208. Differences between EBC and ESO Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Feather River at Thermalito Afterbay

Flow Reduction	Percent Difference between Scenarios[a, b]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
50%	0	0	0	0	0	0
55%	0	0	0	0	0	0
60%	0	0	0	0	0	0
65%	0	0	0	0	0	0
70%	0	0	0	0	0	0
75%	0	0	0	0	0	0
80%	-3	-12	-3	-12	-1	-10
85%	-19	-15	4	9	-30	-35
90%	-64	-53	-65	-54	-64	-6

[a] Negative values indicate reduced cohort exposure under the ESO.
[b] See Table 5C.0-1 for definitions of scenarios.

The number of river lamprey ammocoete cohorts that may be stranded by month-over-month flow reductions in the Feather River at Thermalito Afterbay is presented in Figure 5C.5.2-136, and differences between model scenarios are presented in Table 5C.5.2-209. Differences in the number of river lamprey ammocoetes exposed to flow reductions between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT are predicted to generally be negligible for all flow reductions examined, except in the ELT at the 80%, 85%, and 90% flow reduction. For the 80%, 85%, and 90% flow reductions, ammocoete stranding risk would be 5% to 64% lower under the ESO_ELT relative to the EBC2_ELT and 7% to 41% lower under the ESO_LLT relative to the EBC2_LLT. These results indicate that there are generally no effects of flow reductions under the ESO on river lamprey stranding risk at the lower flow reduction range and benefits of the ESO at higher flow reduction range.

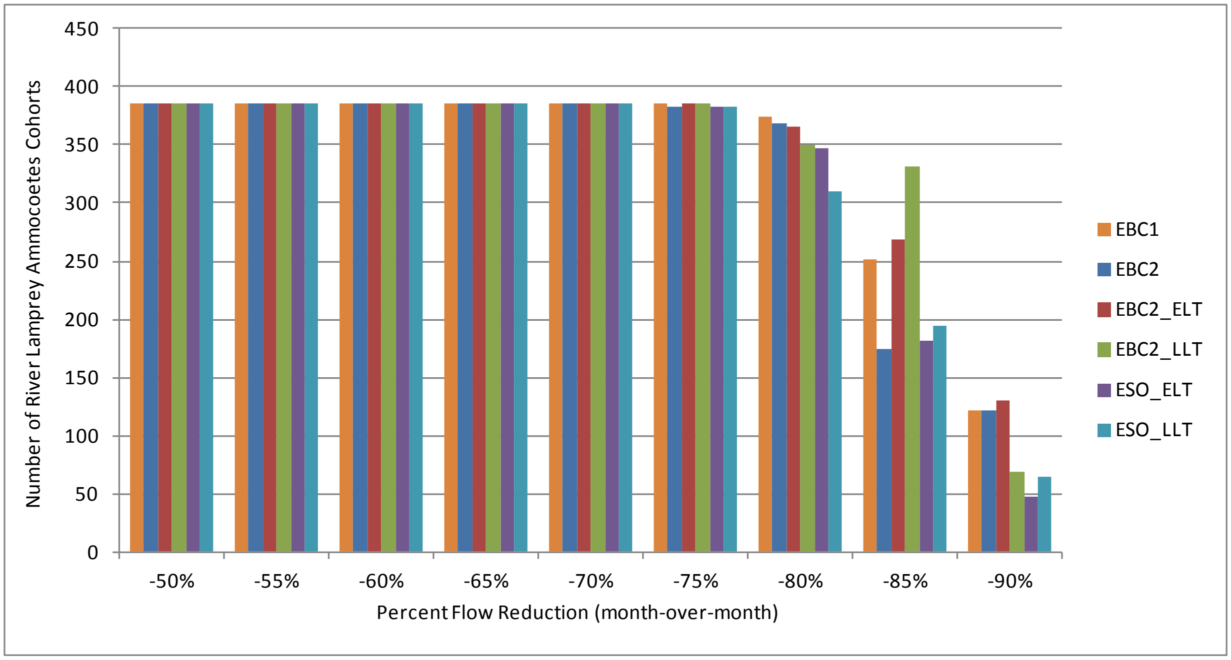


Figure 5C.5.2-136. Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions of 50% to 90%, Feather River at Thermalito Afterbay, under EBC and ESO Scenarios

Table 5C.5.2-209. Differences between EBC and ESO Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Feather River at Thermalito Afterbay

Flow Reduction	Percent Difference between Scenarios[a, b]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
50%	0	0	0	0	0	0
55%	0	0	0	0	0	0
60%	0	0	0	0	0	0
65%	0	0	0	0	0	0
70%	0	0	0	0	0	0
75%	-1	-1	0	0	-1	-1
80%	-7	-17	-6	-16	-5	-11
85%	-28	-23	4	11	-32	-41
90%	-62	-48	-62	-48	-64	-7

[a] Negative values indicate reduced cohort exposure under ESO.
[b] See Table 5C.0-1 for definitions of scenarios.

Due to the differences in flows between the ESO and HOS and LOS scenarios in the Feather River, the stranding risk analysis was conducted for HOS and LOS scenarios. The number of Pacific lamprey ammocoete cohorts that may be stranded by month-over-month flow reductions in the Feather River at Thermalito Afterbay in ESO, HOS, and LOS scenarios is presented in Figure 5C.5.2-137 and differences between model scenarios are presented in Table 5C.5.2-210. There would be no differences in stranding risk between the ESO model scenario and HOS and LOS scenarios for the 50% to 75% flow reduction range. There would be small increases in stranding risk under HSO and LOS scenarios at the 80% flow reduction and moderate to large increases in stranding risk at the 85% and 90% flow reductions.

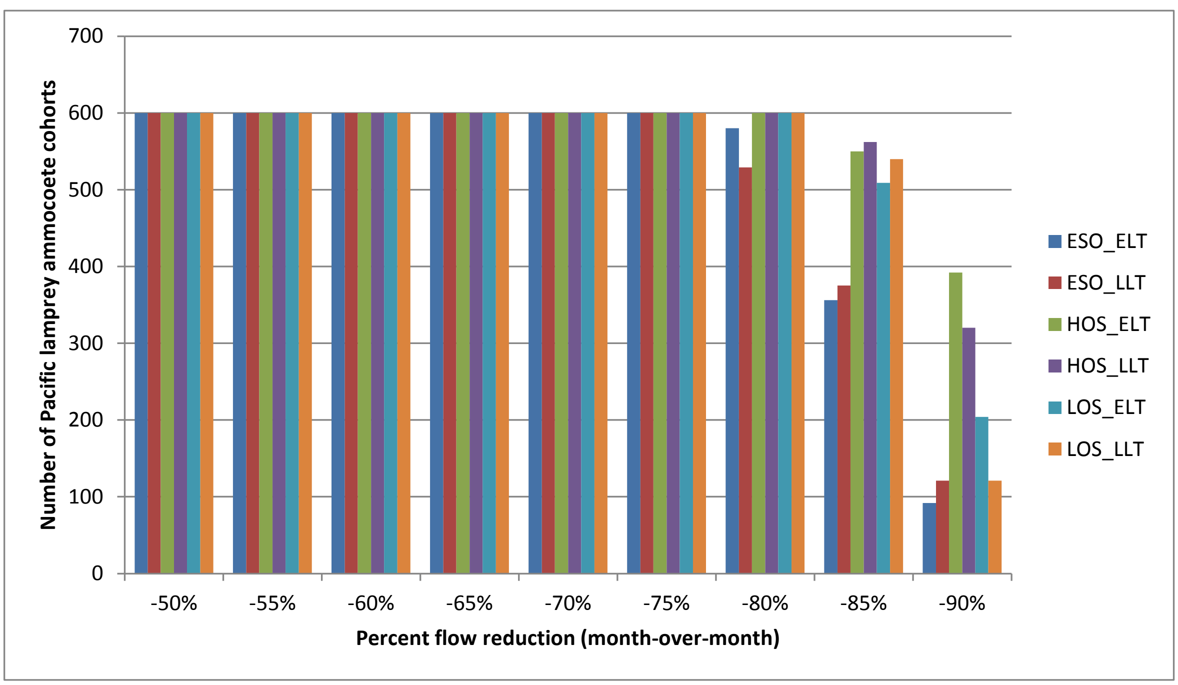


Figure 5C.5.2-137. Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions of 50% to 90%, Feather River at Thermalito Afterbay, for ESO, HOS, and LOS Scenarios

Table 5C.5.2-210. Differences between the ESO Scenarios and HOS and LOS Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Feather River at Thermalito Afterbay

	Percent Difference between Scenarios[a, b]			
Flow Reduction	ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
50%	0.0	0.0	0.0	0.0
55%	0.0	0.0	0.0	0.0
60%	0.0	0.0	0.0	0.0
65%	0.0	0.0	0.0	0.0
70%	0.0	0.0	0.0	0.0
75%	0.0	0.0	0.0	0.0
80%	3.4	13.4	3.4	13.4
85%	54.5	49.9	43.0	44.0
90%	326.1	164.5	121.7	0.0

[a] Negative values indicate reduced cohort exposure under HOS or LOS.
[b] See Table 5C.0-1 for definitions of scenarios.

The number of river lamprey ammocoete cohorts that may be stranded by month-over-month flow reductions in the Feather River at Thermalito Afterbay in ESO, HOS, and LOS scenarios is presented in Figure 5C.5.2-138 and differences between model scenarios are presented in Table 5C.5.2-211. There would be no differences in stranding risk between the ESO model scenario and HOS and LOS scenarios for the 50% to 75% flow reduction range. There would be small increases in stranding risk under HSO and LOS scenarios at the 80% flow reduction and moderate to large increases in stranding risk at the 85% and 90% flow reductions.

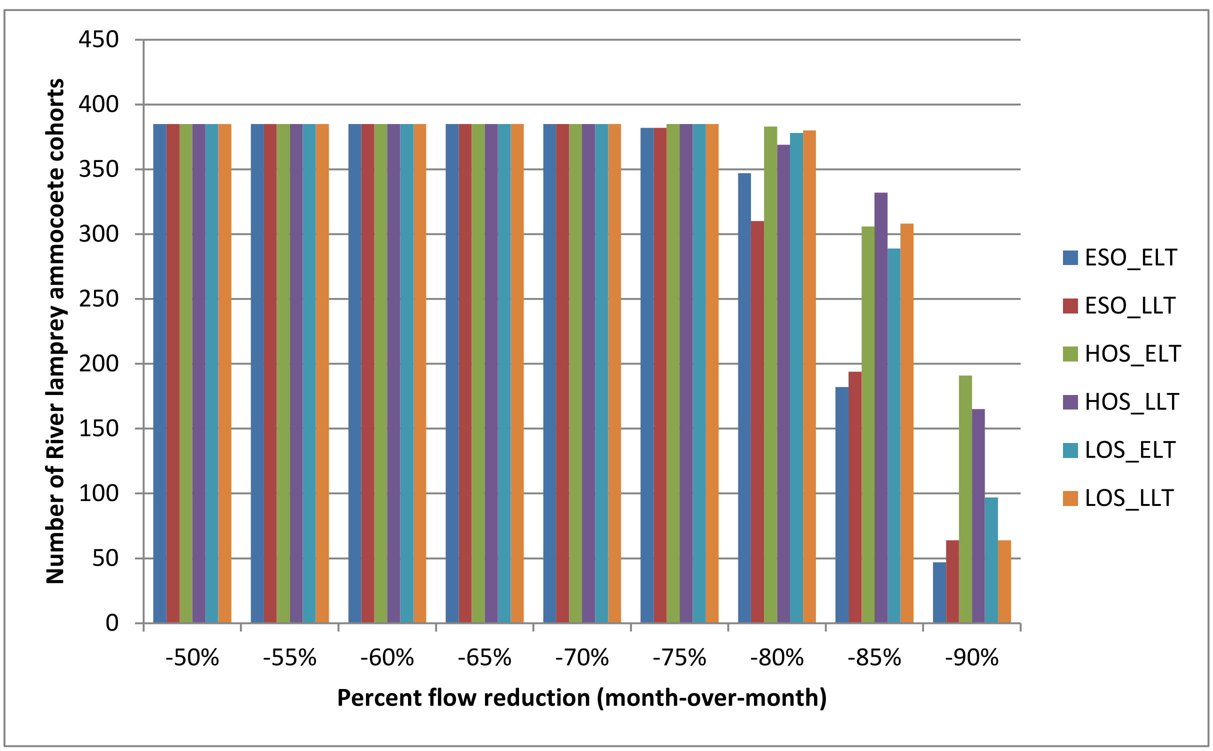


Figure 5C.5.2-138. Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions of 50% to 90%, Feather River at Thermalito Afterbay, for ESO, HOS, and LOS Scenarios

Table 5C.5.2-211. Differences between ESO Scenarios and HOS and LOS Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Feather River at Thermalito Afterbay

Flow Reduction	Percent Difference between Scenarios[a, b]			
	ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
50%	0.0	0.0	0.0	0.0
55%	0.0	0.0	0.0	0.0
60%	0.0	0.0	0.0	0.0
65%	0.0	0.0	0.0	0.0
70%	0.0	0.0	0.0	0.0
75%	0.8	0.8	0.8	0.8
80%	10.4	19.0	8.9	22.6
85%	68.1	71.1	58.8	58.8
90%	306.4	157.8	106.4	0.0

[a] Negative values indicate reduced cohort exposure under HOS or LOS.
[b] See Table 5C.0-1 for definitions of scenarios.

5C.5.2.5 American River

5C.5.2.5.1 Steelhead

5C.5.2.5.1.1 Eggs and Alevins

Upstream Spawning Habitat

The two primary potential effects of BDCP operations on habitat conditions for steelhead spawning and egg incubation on the lower American River relate to changes in either instream flows or seasonal water temperatures released from Folsom and Nimbus dams. The primary spawning and egg incubation period extends from January through April. Results of the CALSIM analyses of instream flows within the lower American River at the confluence with the Sacramento River were compared among model scenarios by month and water-year type. Average flows by month and water-year type for each model scenario in the American River below Nimbus Dam and at the confluence with the Sacramento River are presented in Table 5C.5.2-212 and Table 5C.5.2-214, respectively. Differences between pairs of model scenarios for below Nimbus Dam and at the confluence are presented in Table 5C.5.2-213 and Table 5C.5.2-215 respectively. Monthly frequency of exceedance plots of flows below Nimbus Dam and at the confluence for all months are presented in Figure 5C.5.2-139 through Figure 5C.5.2-150 and Figure 5C.5.2-151 through Figure 5C.5.2-162, respectively. Exceedance plots specific to the primary steelhead spawning and egg incubation period (January through April) for below Nimbus Dam and at the confluence are presented in Figure 5C.5.2-139 through Figure 5C.5.2-142 and Figure 5C.5.2-151 through Figure 5C.5.2-154, respectively. Flows under ESO_ELT and ESO_LLT in both locations would generally be similar to flows under EBC2_ELT and EBC2_LLT throughout the January through April period with few exceptions.

Flows in the American River below Nimbus Dam and at the confluence with the Sacramento River during the primary January through April steelhead spawning period under HOS and LOS scenarios would generally not differ from flows under ESO regardless of month and water-year type (Table 5C.5.2-216 through Table 5C.5.2-219).

Overall, these results indicate that there would be no flow-related effects of the ESO, HOS, or LOS on spawning and egg incubation habitat for steelhead.

Table 5C.5.2-212. Mean Monthly Flows (cfs) in the American River below Nimbus Dam under EBC and ESO Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	8,806	8,633	10,113	11,036	10,103	11,040
	AN	4,833	4,527	4,941	5,805	4,989	5,753
	BN	2,392	2,264	2,334	2,073	2,085	2,026
	D	1,723	1,650	1,620	1,506	1,561	1,417
	C	1,474	1,468	1,241	1,095	1,315	1,258
	AVG	4,502	4,363	4,865	5,194	4,825	5,184
Feb	W	9,294	9,117	10,422	11,102	10,460	11,107
	AN	6,469	6,207	7,220	8,153	7,484	8,243
	BN	4,360	4,133	4,706	4,961	4,896	4,934
	D	1,852	1,776	1,769	1,844	1,709	1,972
	C	1,185	1,165	1,073	1,007	1,120	1,036
	AVG	5,218	5,065	5,710	6,112	5,787	6,155
Mar	W	6,089	6,054	6,454	6,992	6,454	6,987
	AN	5,454	5,336	5,762	5,790	5,815	5,811
	BN	2,429	2,386	2,622	2,794	2,648	2,842
	D	2,191	2,058	2,184	2,314	2,277	2,194
	C	939	948	888	938	868	872
	AVG	3,762	3,698	3,947	4,187	3,976	4,160
Apr	W	5,300	5,197	5,368	5,508	5,368	5,517
	AN	3,546	3,454	3,356	3,298	3,353	3,301
	BN	3,126	2,977	3,117	2,970	3,141	2,952
	D	1,837	1,883	1,761	1,888	1,800	1,884
	C	1,156	1,188	1,091	1,255	1,244	1,270
	AVG	3,305	3,249	3,271	3,334	3,306	3,336
May	W	6,157	5,968	5,673	4,592	5,672	4,674
	AN	3,885	3,649	3,148	2,521	3,259	2,775
	BN	2,930	2,798	2,466	1,969	2,658	2,381
	D	1,790	1,717	1,629	1,686	1,711	2,029
	C	1,182	1,196	1,319	992	1,332	1,002
	AVG	3,587	3,456	3,231	2,676	3,300	2,886
Jun	W	6,003	5,774	4,521	3,694	4,760	4,373
	AN	3,346	3,270	2,855	3,022	3,451	3,597
	BN	2,863	2,646	2,558	2,883	3,089	3,517
	D	2,506	2,417	2,564	2,596	3,131	2,815
	C	1,824	1,656	1,297	1,025	1,289	1,226
	AVG	3,699	3,534	3,041	2,825	3,417	3,311

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jul	W	4,108	3,896	3,571	3,860	3,972	3,706
	AN	4,638	4,425	4,634	4,927	4,644	4,738
	BN	4,744	4,835	4,544	4,328	4,647	4,198
	D	3,577	3,270	3,091	3,143	3,142	2,771
	C	1,784	1,476	1,670	2,022	1,693	2,070
	AVG	3,838	3,642	3,509	3,670	3,670	3,496
Aug	W	3,520	3,265	2,576	2,132	2,381	2,118
	AN	2,542	2,604	2,200	1,944	2,086	1,971
	BN	2,495	2,445	2,313	2,324	2,197	1,757
	D	2,613	2,313	1,779	1,620	1,412	1,369
	C	1,500	1,326	1,308	1,100	1,088	855
	AVG	2,707	2,535	2,115	1,874	1,905	1,685
Sep	W	4,025	4,307	3,982	3,622	3,361	3,026
	AN	2,764	3,106	2,645	2,044	2,187	1,819
	BN	2,370	2,106	1,915	1,605	1,492	1,377
	D	1,856	1,574	1,373	1,182	1,360	1,228
	C	1,164	1,055	761	594	703	662
	AVG	2,663	2,680	2,389	2,068	2,042	1,827
Oct	W	1,723	1,620	1,700	1,634	1,594	1,491
	AN	1,706	1,422	1,609	1,732	1,546	1,663
	BN	1,602	1,530	1,517	1,767	1,765	2,001
	D	1,468	1,341	1,479	1,258	1,414	1,430
	C	1,461	1,405	1,375	1,655	1,679	1,650
	AVG	1,605	1,483	1,559	1,592	1,589	1,613
Nov	W	3,527	3,475	3,436	2,612	2,984	2,508
	AN	3,181	3,486	3,187	2,554	2,878	2,406
	BN	2,067	2,233	1,985	1,716	1,696	1,593
	D	2,176	2,063	1,725	1,424	1,694	1,494
	C	1,994	1,966	1,707	1,608	1,653	1,490
	AVG	2,706	2,734	2,523	2,043	2,271	1,965
Dec	W	6,302	5,691	6,671	6,171	6,798	6,090
	AN	3,137	2,995	3,089	2,933	3,030	2,927
	BN	2,676	2,519	2,857	2,527	3,009	2,591
	D	1,741	1,696	1,643	1,351	1,606	1,340
	C	1,524	1,463	1,374	1,251	1,442	1,315
	AVG	3,519	3,259	3,617	3,297	3,676	3,288

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of scenarios.

1 **Table 5C.5.2-213. Differences[a] between EBC and ESO Scenarios in Mean Monthly Flows in the**
2 **American River below Nimbus Dame**

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	1297 (14.7%)	2233 (25.4%)	1470 (17%)	2407 (27.9%)	-10 (-0.1%)	3 (0.03%)
	AN	156 (3.2%)	921 (19%)	462 (10.2%)	1226 (27.1%)	48 (1%)	-51 (-0.9%)
	BN	-307 (-12.8%)	-366 (-15.3%)	-178 (-7.9%)	-237 (-10.5%)	-248 (-10.6%)	-47 (-2.2%)
	D	-162 (-9.4%)	-306 (-17.7%)	-89 (-5.4%)	-233 (-14.1%)	-59 (-3.6%)	-89 (-5.9%)
	C	-159 (-10.8%)	-216 (-14.7%)	-153 (-10.4%)	-211 (-14.3%)	74 (6%)	163 (14.9%)
	All	323 (7.2%)	682 (15.1%)	461 (10.6%)	820 (18.8%)	-41 (-0.8%)	-10 (-0.2%)
Feb	W	1167 (12.6%)	1814 (19.5%)	1344 (14.7%)	1991 (21.8%)	38 (0.4%)	5 (0.05%)
	AN	1015 (15.7%)	1774 (27.4%)	1277 (20.6%)	2036 (32.8%)	264 (3.7%)	90 (1.1%)
	BN	536 (12.3%)	574 (13.2%)	763 (18.5%)	801 (19.4%)	190 (4%)	-27 (-0.5%)
	D	-143 (-7.7%)	120 (6.5%)	-66 (-3.7%)	197 (11.1%)	-59 (-3.3%)	128 (7%)
	C	-66 (-5.5%)	-149 (-12.6%)	-45 (-3.9%)	-128 (-11%)	46 (4.3%)	30 (2.9%)
	All	569 (10.9%)	937 (18%)	722 (14.3%)	1090 (21.5%)	77 (1.3%)	43 (0.7%)
Mar	W	365 (6%)	898 (14.8%)	400 (6.6%)	933 (15.4%)	0 (0%)	-5 (-0.1%)
	AN	362 (6.6%)	358 (6.6%)	479 (9%)	475 (8.9%)	53 (0.9%)	21 (0.4%)
	BN	219 (9%)	413 (17%)	262 (11%)	456 (19.1%)	26 (1%)	48 (1.7%)
	D	85 (3.9%)	3 (0.1%)	219 (10.6%)	136 (6.6%)	92 (4.2%)	-121 (-5.2%)
	C	-71 (-7.6%)	-68 (-7.2%)	-80 (-8.4%)	-76 (-8%)	-20 (-2.3%)	-66 (-7.1%)
	All	214 (5.7%)	398 (10.6%)	278 (7.5%)	462 (12.5%)	29 (0.7%)	-27 (-0.6%)
Apr	W	68 (1.3%)	217 (4.1%)	171 (3.3%)	320 (6.2%)	0 (0%)	9 (0.2%)
	AN	-193 (-5.4%)	-245 (-6.9%)	-102 (-2.9%)	-154 (-4.4%)	-3 (-0.1%)	2 (0.1%)
	BN	15 (0.5%)	-174 (-5.6%)	164 (5.5%)	-25 (-0.8%)	24 (0.8%)	-18 (-0.6%)
	D	-38 (-2%)	47 (2.5%)	-84 (-4.4%)	1 (0%)	39 (2.2%)	-4 (-0.2%)
	C	88 (7.6%)	115 (9.9%)	56 (4.7%)	82 (6.9%)	153 (14%)	15 (1.2%)
	All	0 (0%)	30 (0.9%)	57 (1.8%)	87 (2.7%)	35 (1.1%)	1 (0.04%)
May	W	-485 (-7.9%)	-1483 (-24.1%)	-296 (-5%)	-1294 (-21.7%)	-1 (-0.02%)	82 (1.8%)
	AN	-626 (-16.1%)	-1110 (-28.6%)	-390 (-10.7%)	-874 (-24%)	111 (3.5%)	254 (10.1%)
	BN	-272 (-9.3%)	-549 (-18.7%)	-140 (-5%)	-417 (-14.9%)	192 (7.8%)	412 (20.9%)
	D	-78 (-4.4%)	240 (13.4%)	-6 (-0.3%)	312 (18.2%)	82 (5%)	343 (20.4%)
	C	151 (12.7%)	-180 (-15.2%)	137 (11.4%)	-194 (-16.2%)	13 (1%)	10 (1%)
	All	-287 (-8%)	-700 (-19.5%)	-156 (-4.5%)	-569 (-16.5%)	68 (2.1%)	210 (7.9%)
Jun	W	-1244 (-20.7%)	-1630 (-27.1%)	-1014 (-17.6%)	-1401 (-24.3%)	239 (5.3%)	680 (18.4%)
	AN	105 (3.2%)	252 (7.5%)	181 (5.5%)	327 (10%)	596 (20.9%)	575 (19%)
	BN	226 (7.9%)	654 (22.8%)	443 (16.8%)	872 (33%)	531 (20.8%)	635 (22%)
	D	625 (25%)	310 (12.4%)	714 (29.5%)	398 (16.5%)	566 (22.1%)	219 (8.4%)
	C	-535 (-29.3%)	-598 (-32.8%)	-367 (-22.2%)	-430 (-26%)	-8 (-0.6%)	201 (19.6%)
	All	-281 (-7.6%)	-388 (-10.5%)	-117 (-3.3%)	-223 (-6.3%)	377 (12.4%)	486 (17.2%)
Jul	W	-137 (-3.3%)	-402 (-9.8%)	76 (2%)	-189 (-4.9%)	401 (11.2%)	-154 (-4%)
	AN	6 (0.1%)	100 (2.2%)	219 (5%)	314 (7.1%)	9 (0.2%)	-189 (-3.8%)
	BN	-97 (-2%)	-547 (-11.5%)	-188 (-3.9%)	-638 (-13.2%)	103 (2.3%)	-131 (-3%)
	D	-435 (-12.2%)	-807 (-22.5%)	-128 (-3.9%)	-500 (-15.3%)	51 (1.6%)	-373 (-11.9%)
	C	-92 (-5.1%)	286 (16%)	216 (14.7%)	594 (40.2%)	22 (1.3%)	48 (2.4%)
	All	-168 (-4.4%)	-341 (-8.9%)	28 (0.8%)	-146 (-4%)	160 (4.6%)	-174 (-4.7%)

Month	Water-Year Type[b]	Scenarios[c] EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Aug	W	-1139 (-32.4%)	-1402 (-39.8%)	-884 (-27.1%)	-1147 (-35.1%)	-195 (-7.6%)	-14 (-0.7%)
	AN	-456 (-17.9%)	-571 (-22.5%)	-517 (-19.9%)	-633 (-24.3%)	-114 (-5.2%)	26 (1.4%)
	BN	-298 (-11.9%)	-738 (-29.6%)	-248 (-10.1%)	-688 (-28.1%)	-116 (-5%)	-568 (-24.4%)
	D	-1201 (-46%)	-1244 (-47.6%)	-901 (-39%)	-944 (-40.8%)	-367 (-20.6%)	-251 (-15.5%)
	C	-412 (-27.4%)	-645 (-43%)	-238 (-17.9%)	-471 (-35.5%)	-219 (-16.8%)	-245 (-22.3%)
	All	-803 (-29.6%)	-1022 (-37.7%)	-631 (-24.9%)	-850 (-33.5%)	-211 (-10%)	-189 (-10.1%)
Sep	W	-663 (-16.5%)	-998 (-24.8%)	-946 (-22%)	-1281 (-29.7%)	-621 (-15.6%)	-596 (-16.5%)
	AN	-577 (-20.9%)	-945 (-34.2%)	-919 (-29.6%)	-1287 (-41.4%)	-457 (-17.3%)	-225 (-11%)
	BN	-879 (-37.1%)	-994 (-41.9%)	-614 (-29.2%)	-729 (-34.6%)	-423 (-22.1%)	-228 (-14.2%)
	D	-496 (-26.7%)	-628 (-33.9%)	-213 (-13.6%)	-346 (-22%)	-13 (-1%)	46 (3.9%)
	C	-462 (-39.6%)	-503 (-43.2%)	-352 (-33.4%)	-393 (-37.3%)	-58 (-7.6%)	68 (11.5%)
	All	-621 (-23.3%)	-836 (-31.4%)	-638 (-23.8%)	-852 (-31.8%)	-348 (-14.5%)	-241 (-11.6%)
Oct	W	-129 (-7.5%)	-232 (-13.5%)	-26 (-1.6%)	-129 (-8%)	-106 (-6.2%)	-143 (-8.8%)
	AN	-160 (-9.4%)	-43 (-2.5%)	124 (8.7%)	241 (17%)	-63 (-3.9%)	-68 (-4%)
	BN	163 (10.2%)	399 (24.9%)	235 (15.4%)	471 (30.8%)	248 (16.4%)	235 (13.3%)
	D	-54 (-3.7%)	-38 (-2.6%)	73 (5.4%)	88 (6.6%)	-65 (-4.4%)	172 (13.6%)
	C	219 (15%)	189 (13%)	275 (19.5%)	245 (17.4%)	304 (22.1%)	-5 (-0.3%)
	All	-16 (-1%)	8 (0.5%)	106 (7.2%)	130 (8.8%)	30 (1.9%)	22 (1.4%)
Nov	W	-543 (-15.4%)	-1019 (-28.9%)	-491 (-14.1%)	-967 (-27.8%)	-452 (-13.2%)	-104 (-4%)
	AN	-303 (-9.5%)	-774 (-24.3%)	-608 (-17.5%)	-1080 (-31%)	-309 (-9.7%)	-148 (-5.8%)
	BN	-371 (-18%)	-475 (-23%)	-537 (-24.1%)	-641 (-28.7%)	-289 (-14.6%)	-124 (-7.2%)
	D	-482 (-22.2%)	-682 (-31.3%)	-369 (-17.9%)	-569 (-27.6%)	-30 (-1.8%)	70 (4.9%)
	C	-341 (-17.1%)	-504 (-25.3%)	-313 (-15.9%)	-476 (-24.2%)	-54 (-3.1%)	-118 (-7.3%)
	All	-436 (-16.1%)	-741 (-27.4%)	-463 (-16.9%)	-769 (-28.1%)	-252 (-10%)	-77 (-3.8%)
Dec	W	497 (7.9%)	-211 (-3.4%)	1107 (19.5%)	399 (7%)	127 (1.9%)	-81 (-1.3%)
	AN	-107 (-3.4%)	-209 (-6.7%)	35 (1.2%)	-67 (-2.2%)	-60 (-1.9%)	-5 (-0.2%)
	BN	333 (12.5%)	-85 (-3.2%)	490 (19.4%)	71 (2.8%)	152 (5.3%)	64 (2.5%)
	D	-135 (-7.7%)	-401 (-23%)	-90 (-5.3%)	-356 (-21%)	-37 (-2.3%)	-11 (-0.8%)
	C	-82 (-5.4%)	-209 (-13.7%)	-21 (-1.4%)	-148 (-10.1%)	68 (4.9%)	64 (5.1%)
	All	157 (4.5%)	-231 (-6.6%)	417 (12.8%)	29 (0.9%)	59 (1.6%)	-8 (-0.3%)

[a] Positive values indicate higher flows under ESO than under EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of scenarios.

Table 5C.5.2-214. Mean Monthly Flows (cfs) in the American River at the Confluence with the Sacramento River

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	8,748	8,560	10,031	10,960	10,021	10,964
	AN	4,806	4,482	4,895	5,760	4,944	5,709
	BN	2,326	2,179	2,246	1,988	1,997	1,941
	D	1,654	1,565	1,535	1,424	1,477	1,336
	C	1,403	1,379	1,152	1,008	1,226	1,176
	AVG	4,443	4,287	4,786	5,118	4,745	5,109
Feb	W	9,183	8,982	10,275	10,947	10,313	10,952
	AN	6,422	6,139	7,148	8,073	7,412	8,163
	BN	4,309	4,058	4,631	4,888	4,824	4,862
	D	1,781	1,686	1,679	1,756	1,621	1,886
	C	1,119	1,074	985	921	1,030	956
	AVG	5,142	4,967	5,607	6,007	5,685	6,051
Mar	W	5,979	5,915	6,304	6,837	6,303	6,831
	AN	5,364	5,224	5,641	5,661	5,692	5,681
	BN	2,340	2,271	2,503	2,672	2,527	2,721
	D	2,121	1,968	2,095	2,224	2,187	2,102
	C	864	843	785	836	764	782
	AVG	3,672	3,583	3,826	4,063	3,855	4,038
Apr	W	5,156	4,997	5,164	5,300	5,164	5,309
	AN	3,383	3,238	3,136	3,079	3,132	3,081
	BN	2,984	2,788	2,927	2,778	2,950	2,760
	D	1,672	1,673	1,550	1,677	1,588	1,673
	C	996	985	886	1,059	1,040	1,075
	AVG	3,152	3,046	3,066	3,128	3,100	3,130
May	W	5,959	5,711	5,415	4,332	5,414	4,414
	AN	3,700	3,411	2,911	2,285	3,022	2,540
	BN	2,733	2,555	2,222	1,726	2,413	2,138
	D	1,605	1,484	1,399	1,454	1,480	1,797
	C	1,014	992	1,118	790	1,129	800
	AVG	3,398	3,217	2,993	2,438	3,061	2,648
Jun	W	5,743	5,456	4,206	3,388	4,445	4,068
	AN	3,103	2,973	2,562	2,736	3,158	3,309
	BN	2,631	2,358	2,274	2,603	2,803	3,234
	D	2,282	2,140	2,289	2,320	2,855	2,536
	C	1,621	1,412	1,052	793	1,044	994
	AVG	3,462	3,244	2,753	2,545	3,129	3,028
Jul	W	3,844	3,578	3,264	3,560	3,663	3,400
	AN	4,399	4,131	4,344	4,635	4,348	4,441
	BN	4,509	4,548	4,257	4,038	4,356	3,902
	D	3,347	2,987	2,807	2,858	2,852	2,484
	C	1,568	1,218	1,421	1,784	1,439	1,829
	AVG	3,597	3,349	3,221	3,385	3,378	3,207

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Aug	W	3,295	2,990	2,304	1,858	2,106	1,845
	AN	2,313	2,327	1,921	1,663	1,807	1,691
	BN	2,265	2,164	2,035	2,048	1,918	1,482
	D	2,395	2,049	1,516	1,357	1,149	1,112
	C	1,314	1,094	1,097	899	893	649
	AVG	2,488	2,268	1,852	1,612	1,643	1,425
Sep	W	3,846	4,090	3,771	3,415	3,151	2,819
	AN	2,594	2,894	2,437	1,838	1,980	1,613
	BN	2,205	1,902	1,712	1,402	1,290	1,179
	D	1,691	1,371	1,177	987	1,167	1,035
	C	1,011	877	591	427	535	494
	AVG	2,495	2,474	2,189	1,870	1,844	1,631
Oct	W	1,607	1,479	1,561	1,499	1,458	1,357
	AN	1,597	1,291	1,481	1,613	1,421	1,539
	BN	1,472	1,376	1,364	1,617	1,617	1,862
	D	1,344	1,190	1,333	1,114	1,271	1,289
	C	1,342	1,260	1,232	1,517	1,537	1,521
	AVG	1,486	1,338	1,418	1,454	1,451	1,479
Nov	W	3,472	3,402	3,363	2,540	2,912	2,437
	AN	3,100	3,389	3,089	2,455	2,780	2,308
	BN	1,990	2,137	1,889	1,618	1,598	1,492
	D	2,094	1,964	1,624	1,326	1,594	1,395
	C	1,897	1,849	1,590	1,489	1,534	1,371
	AVG	2,632	2,641	2,430	1,950	2,177	1,872
Dec	W	6,255	5,627	6,607	6,115	6,739	6,035
	AN	3,072	2,909	3,007	2,856	2,950	2,852
	BN	2,609	2,433	2,774	2,445	2,928	2,511
	D	1,675	1,614	1,564	1,275	1,527	1,264
	C	1,443	1,364	1,278	1,158	1,346	1,222
	AVG	3,457	3,179	3,539	3,224	3,600	3,216

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of scenarios.

Table 5C.5.2-215. Differences[a] between EBC and ESO Scenarios in Mean Monthly Flows in the American River at the Confluence with the Sacramento River

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	1274 (14.6%)	2217 (25.3%)	1461 (17.1%)	2404 (28.1%)	-10 (-0.1%)	4 (0.04%)
	AN	138 (2.9%)	903 (18.8%)	462 (10.3%)	1227 (27.4%)	49 (1%)	-52 (-0.9%)
	BN	-330 (-14.2%)	-385 (-16.6%)	-182 (-8.4%)	-238 (-10.9%)	-249 (-11.1%)	-47 (-2.4%)
	D	-178 (-10.7%)	-318 (-19.2%)	-88 (-5.6%)	-229 (-14.6%)	-58 (-3.8%)	-88 (-6.2%)
	C	-177 (-12.6%)	-227 (-16.2%)	-153 (-11.1%)	-203 (-14.7%)	73 (6.4%)	168 (16.7%)
	All	303 (6.8%)	666 (15%)	458 (10.7%)	821 (19.2%)	-41 (-0.9%)	-9 (-0.2%)
Feb	W	1131 (12.3%)	1769 (19.3%)	1331 (14.8%)	1970 (21.9%)	38 (0.4%)	5 (0.05%)
	AN	989 (15.4%)	1740 (27.1%)	1273 (20.7%)	2024 (33%)	264 (3.7%)	90 (1.1%)
	BN	515 (11.9%)	553 (12.8%)	765 (18.9%)	803 (19.8%)	193 (4.2%)	-27 (-0.5%)
	D	-160 (-9%)	105 (5.9%)	-65 (-3.9%)	200 (11.8%)	-59 (-3.5%)	130 (7.4%)
	C	-88 (-7.9%)	-163 (-14.5%)	-44 (-4.1%)	-118 (-11%)	45 (4.6%)	35 (3.8%)
	All	543 (10.6%)	909 (17.7%)	718 (14.5%)	1085 (21.8%)	77 (1.4%)	44 (0.7%)
Mar	W	324 (5.4%)	852 (14.2%)	389 (6.6%)	917 (15.5%)	-1 (-0.01%)	-5 (-0.1%)
	AN	327 (6.1%)	316 (5.9%)	468 (9%)	457 (8.8%)	51 (0.9%)	20 (0.3%)
	BN	187 (8%)	381 (16.3%)	256 (11.3%)	450 (19.8%)	25 (1%)	48 (1.8%)
	D	66 (3.1%)	-18 (-0.9%)	219 (11.1%)	134 (6.8%)	93 (4.4%)	-122 (-5.5%)
	C	-100 (-11.6%)	-82 (-9.5%)	-79 (-9.4%)	-61 (-7.2%)	-21 (-2.6%)	-54 (-6.5%)
	All	183 (5%)	365 (9.9%)	272 (7.6%)	455 (12.7%)	29 (0.8%)	-25 (-0.6%)
Apr	W	8 (0.2%)	153 (3%)	167 (3.3%)	312 (6.2%)	0 (0%)	9 (0.2%)
	AN	-250 (-7.4%)	-301 (-8.9%)	-105 (-3.3%)	-157 (-4.8%)	-4 (-0.1%)	2 (0.1%)
	BN	-33 (-1.1%)	-224 (-7.5%)	162 (5.8%)	-29 (-1%)	24 (0.8%)	-18 (-0.7%)
	D	-85 (-5.1%)	1 (0.1%)	-85 (-5.1%)	1 (0%)	38 (2.4%)	-3 (-0.2%)
	C	45 (4.5%)	79 (8%)	56 (5.6%)	90 (9.2%)	154 (17.3%)	15 (1.5%)
	All	-52 (-1.6%)	-22 (-0.7%)	55 (1.8%)	85 (2.8%)	34 (1.1%)	2 (0.1%)
May	W	-545 (-9.1%)	-1545 (-25.9%)	-297 (-5.2%)	-1297 (-22.7%)	-1 (-0.03%)	82 (1.9%)
	AN	-677 (-18.3%)	-1160 (-31.4%)	-389 (-11.4%)	-872 (-25.6%)	111 (3.8%)	254 (11.1%)
	BN	-320 (-11.7%)	-595 (-21.8%)	-142 (-5.5%)	-417 (-16.3%)	191 (8.6%)	412 (23.9%)
	D	-125 (-7.8%)	193 (12%)	-4 (-0.3%)	313 (21.1%)	82 (5.8%)	343 (23.6%)
	C	116 (11.4%)	-214 (-21.1%)	138 (13.9%)	-192 (-19.4%)	11 (1%)	9 (1.2%)
	All	-337 (-9.9%)	-750 (-22.1%)	-156 (-4.9%)	-569 (-17.7%)	68 (2.3%)	210 (8.6%)
Jun	W	-1298 (-22.6%)	-1675 (-29.2%)	-1012 (-18.5%)	-1389 (-25.5%)	239 (5.7%)	679 (20%)
	AN	54 (1.7%)	205 (6.6%)	185 (6.2%)	336 (11.3%)	595 (23.2%)	573 (20.9%)
	BN	172 (6.5%)	603 (22.9%)	445 (18.8%)	875 (37.1%)	529 (23.3%)	631 (24.2%)
	D	573 (25.1%)	254 (11.1%)	714 (33.4%)	395 (18.5%)	566 (24.7%)	216 (9.3%)
	C	-578 (-35.6%)	-627 (-38.7%)	-368 (-26.1%)	-418 (-29.6%)	-8 (-0.8%)	201 (25.4%)
	All	-333 (-9.6%)	-434 (-12.5%)	-115 (-3.5%)	-216 (-6.7%)	376 (13.7%)	484 (19%)
Jul	W	-182 (-4.7%)	-444 (-11.5%)	85 (2.4%)	-177 (-5%)	399 (12.2%)	-160 (-4.5%)
	AN	-50 (-1.1%)	43 (1%)	218 (5.3%)	311 (7.5%)	4 (0.1%)	-194 (-4.2%)
	BN	-154 (-3.4%)	-607 (-13.5%)	-192 (-4.2%)	-645 (-14.2%)	98 (2.3%)	-136 (-3.4%)
	D	-495 (-14.8%)	-863 (-25.8%)	-134 (-4.5%)	-503 (-16.8%)	46 (1.6%)	-375 (-13.1%)
	C	-129 (-8.2%)	261 (16.7%)	221 (18.2%)	611 (50.2%)	19 (1.3%)	46 (2.6%)
	All	-219 (-6.1%)	-389 (-10.8%)	29 (0.9%)	-142 (-4.2%)	157 (4.9%)	-178 (-5.3%)

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Aug	W	-1189 (-36.1%)	-1449 (-44%)	-884 (-29.6%)	-1145 (-38.3%)	-198 (-8.6%)	-13 (-0.7%)
	AN	-506 (-21.9%)	-622 (-26.9%)	-519 (-22.3%)	-635 (-27.3%)	-114 (-5.9%)	28 (1.7%)
	BN	-347 (-15.3%)	-783 (-34.6%)	-246 (-11.4%)	-682 (-31.5%)	-117 (-5.7%)	-566 (-27.7%)
	D	-1246 (-52%)	-1283 (-53.6%)	-900 (-43.9%)	-937 (-45.7%)	-367 (-24.2%)	-245 (-18%)
	C	-421 (-32%)	-664 (-50.6%)	-201 (-18.4%)	-445 (-40.7%)	-204 (-18.6%)	-250 (-27.8%)
	All	-845 (-34%)	-1063 (-42.7%)	-625 (-27.6%)	-843 (-37.2%)	-210 (-11.3%)	-187 (-11.6%)
Sep	W	-694 (-18.1%)	-1027 (-26.7%)	-938 (-22.9%)	-1271 (-31.1%)	-619 (-16.4%)	-596 (-17.5%)
	AN	-614 (-23.7%)	-981 (-37.8%)	-914 (-31.6%)	-1281 (-44.3%)	-456 (-18.7%)	-225 (-12.2%)
	BN	-915 (-41.5%)	-1026 (-46.5%)	-612 (-32.2%)	-723 (-38%)	-422 (-24.6%)	-223 (-15.9%)
	D	-524 (-31%)	-656 (-38.8%)	-205 (-14.9%)	-336 (-24.5%)	-10 (-0.8%)	48 (4.9%)
	C	-476 (-47.1%)	-517 (-51.1%)	-342 (-39%)	-383 (-43.7%)	-56 (-9.4%)	67 (15.7%)
	All	-651 (-26.1%)	-864 (-34.6%)	-631 (-25.5%)	-844 (-34.1%)	-346 (-15.8%)	-240 (-12.8%)
Oct	W	-149 (-9.3%)	-250 (-15.6%)	-20 (-1.4%)	-122 (-8.2%)	-103 (-6.6%)	-142 (-9.4%)
	AN	-176 (-11%)	-58 (-3.6%)	130 (10.1%)	248 (19.2%)	-60 (-4.1%)	-74 (-4.6%)
	BN	145 (9.9%)	390 (26.5%)	241 (17.5%)	486 (35.3%)	253 (18.6%)	245 (15.1%)
	D	-72 (-5.4%)	-55 (-4.1%)	81 (6.8%)	99 (8.3%)	-61 (-4.6%)	175 (15.7%)
	C	196 (14.6%)	179 (13.3%)	277 (22%)	260 (20.7%)	305 (24.8%)	4 (0.2%)
	All	-35 (-2.4%)	-7 (-0.5%)	112 (8.4%)	140 (10.5%)	33 (2.3%)	25 (1.7%)
Nov	W	-560 (-16.1%)	-1035 (-29.8%)	-490 (-14.4%)	-965 (-28.4%)	-451 (-13.4%)	-102 (-4%)
	AN	-320 (-10.3%)	-792 (-25.5%)	-609 (-18%)	-1082 (-31.9%)	-309 (-10%)	-147 (-6%)
	BN	-392 (-19.7%)	-498 (-25%)	-539 (-25.2%)	-645 (-30.2%)	-291 (-15.4%)	-126 (-7.8%)
	D	-500 (-23.9%)	-700 (-33.4%)	-370 (-18.8%)	-570 (-29%)	-30 (-1.8%)	68 (5.2%)
	C	-363 (-19.2%)	-526 (-27.7%)	-316 (-17.1%)	-479 (-25.9%)	-56 (-3.6%)	-118 (-7.9%)
	All	-454 (-17.3%)	-760 (-28.9%)	-464 (-17.6%)	-769 (-29.1%)	-253 (-10.4%)	-78 (-4%)
Dec	W	484 (7.7%)	-220 (-3.5%)	1112 (19.8%)	408 (7.3%)	131 (2%)	-80 (-1.3%)
	AN	-121 (-4%)	-219 (-7.1%)	41 (1.4%)	-57 (-2%)	-57 (-1.9%)	-4 (-0.1%)
	BN	319 (12.2%)	-99 (-3.8%)	495 (20.3%)	77 (3.2%)	154 (5.6%)	65 (2.7%)
	D	-148 (-8.8%)	-411 (-24.5%)	-87 (-5.4%)	-350 (-21.7%)	-37 (-2.4%)	-11 (-0.9%)
	C	-97 (-6.7%)	-221 (-15.3%)	-18 (-1.3%)	-142 (-10.4%)	68 (5.3%)	64 (5.6%)
	All	143 (4.1%)	-241 (-7%)	421 (13.2%)	37 (1.2%)	61 (1.7%)	-8 (-0.2%)

[a] Positive values indicate higher flows under ESO than under EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of scenarios.

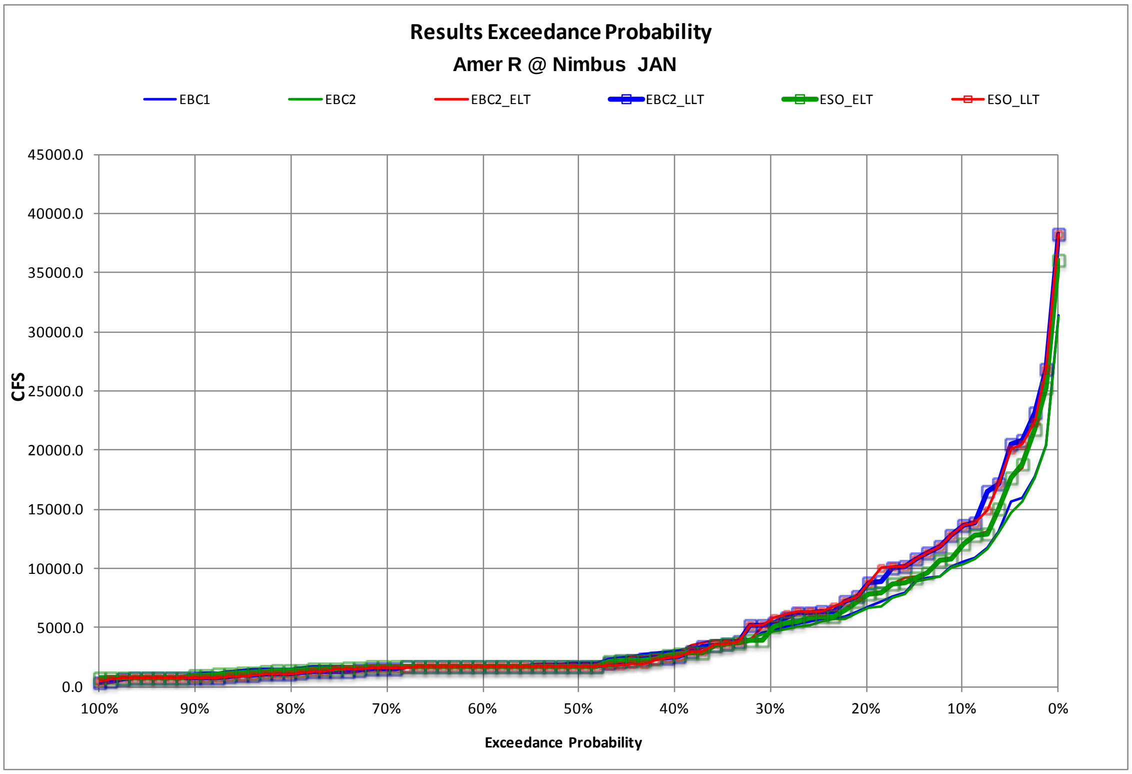


Figure 5C.5.2-139. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the American River below Nimbus Dam, January

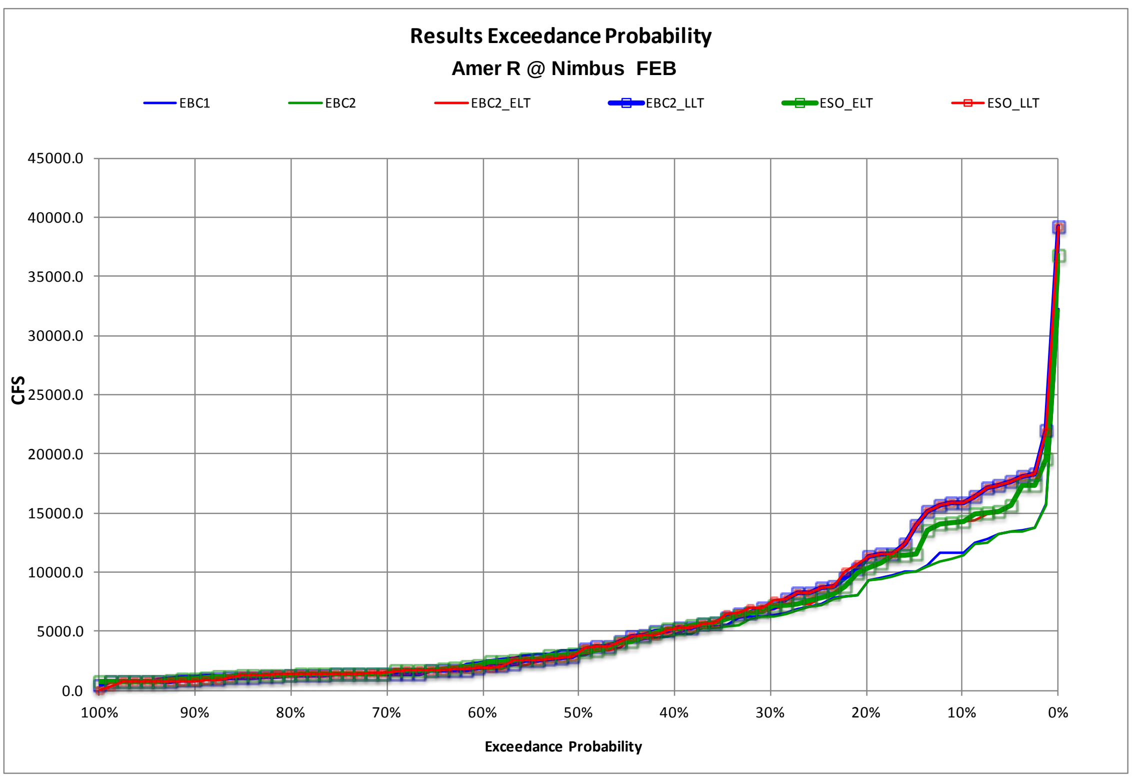


Figure 5C.5.2-140. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the American River below Nimbus Dam, February

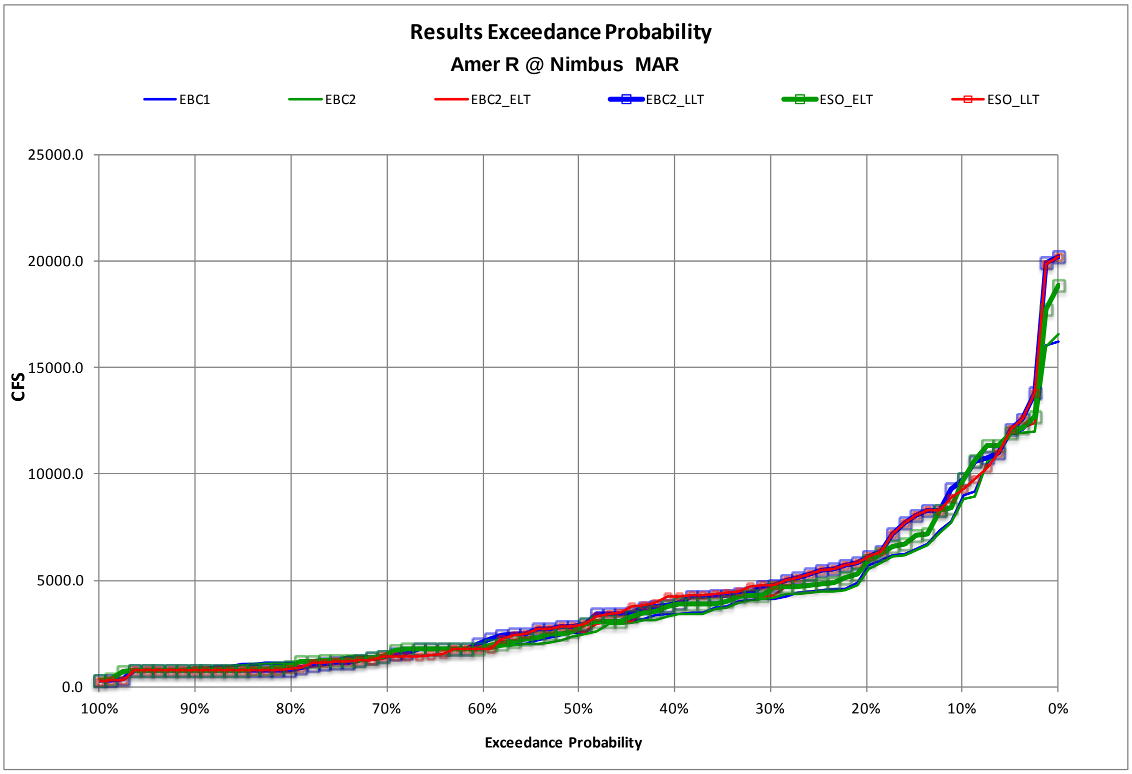


Figure 5C.5.2-141. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the American River below Nimbus Dam, March

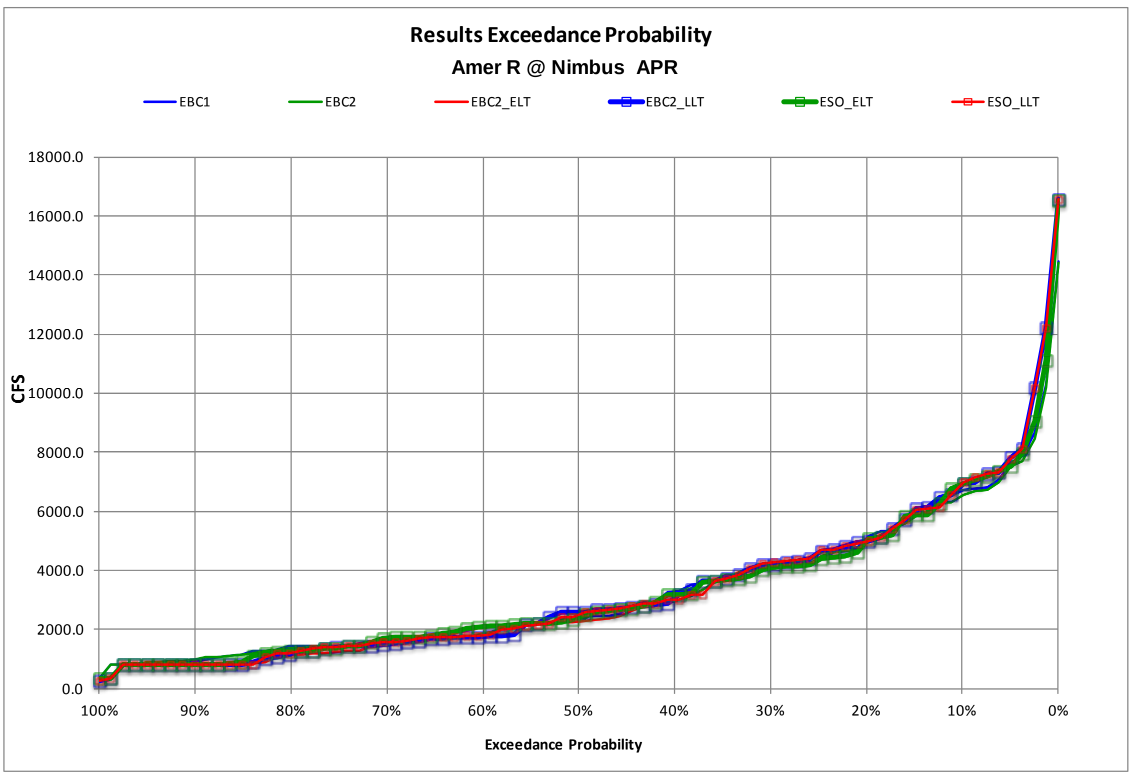


Figure 5C.5.2-142. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the American River below Nimbus Dam, April

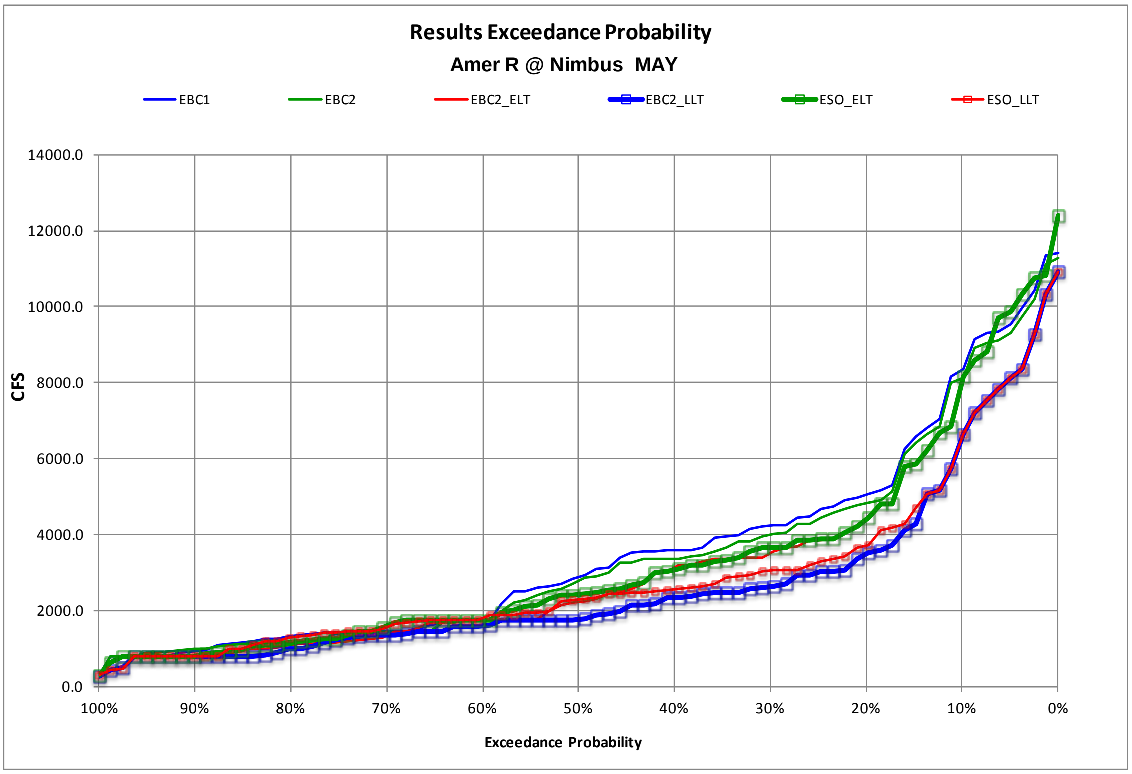


Figure 5C.5.2-143. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the American River below Nimbus Dam, May

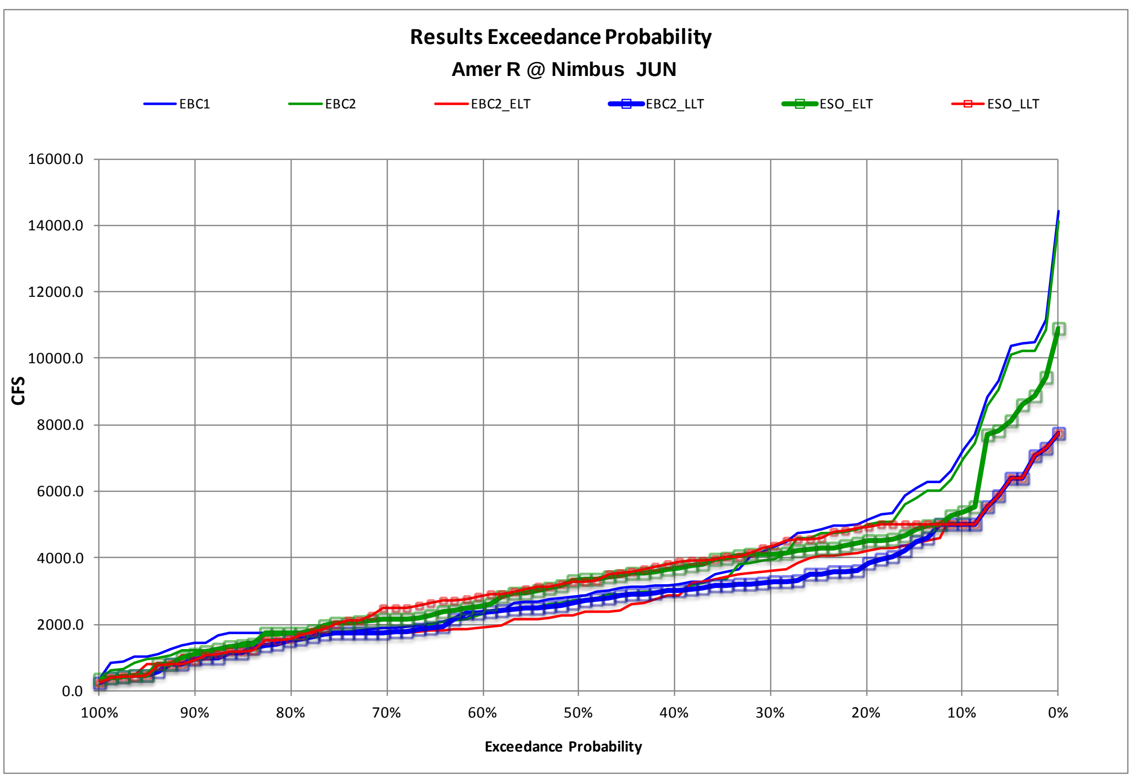


Figure 5C.5.2-144. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the American River below Nimbus Dam, June

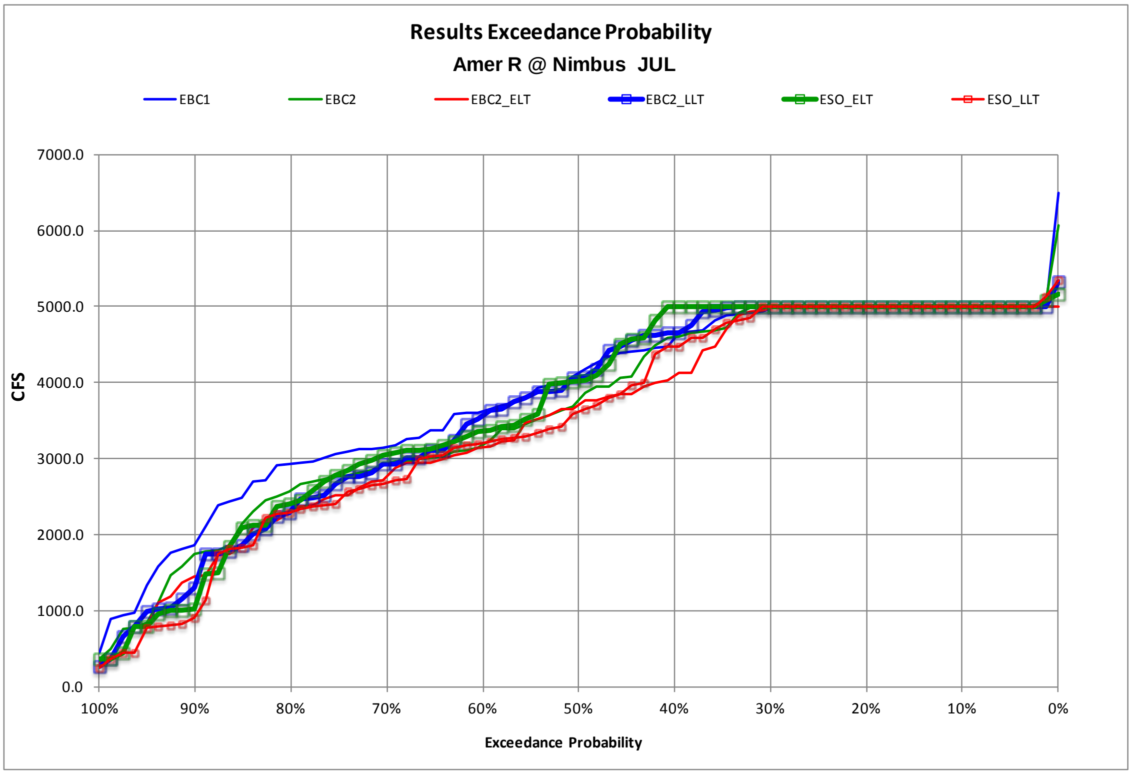


Figure 5C.5.2-145. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the American River below Nimbus Dam, July

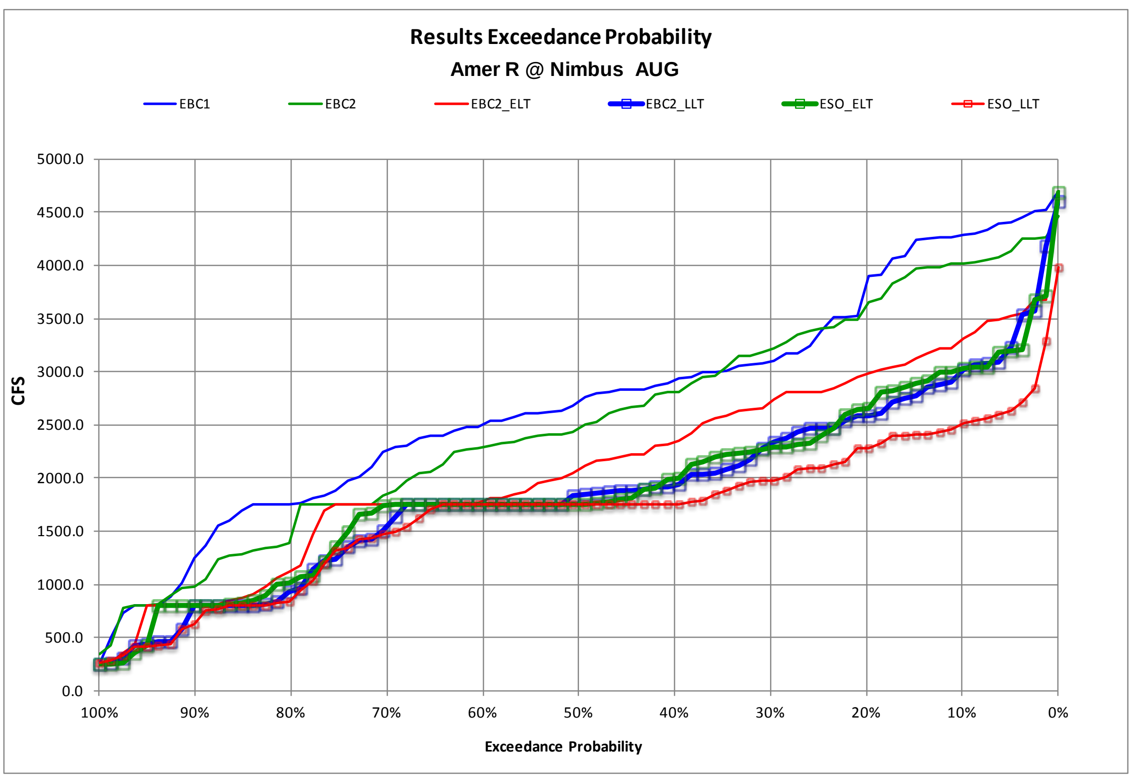


Figure 5C.5.2-146. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the American River below Nimbus Dam, August

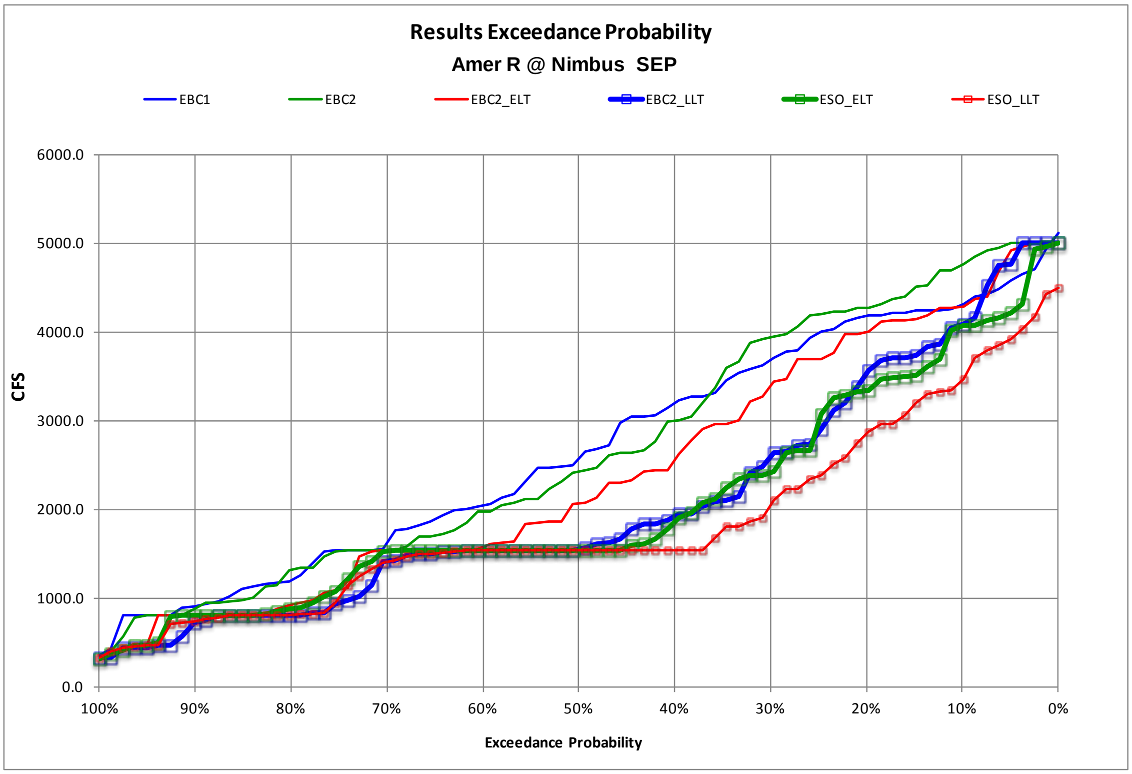


Figure 5C.5.2-147. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the American River below Nimbus Dam, September

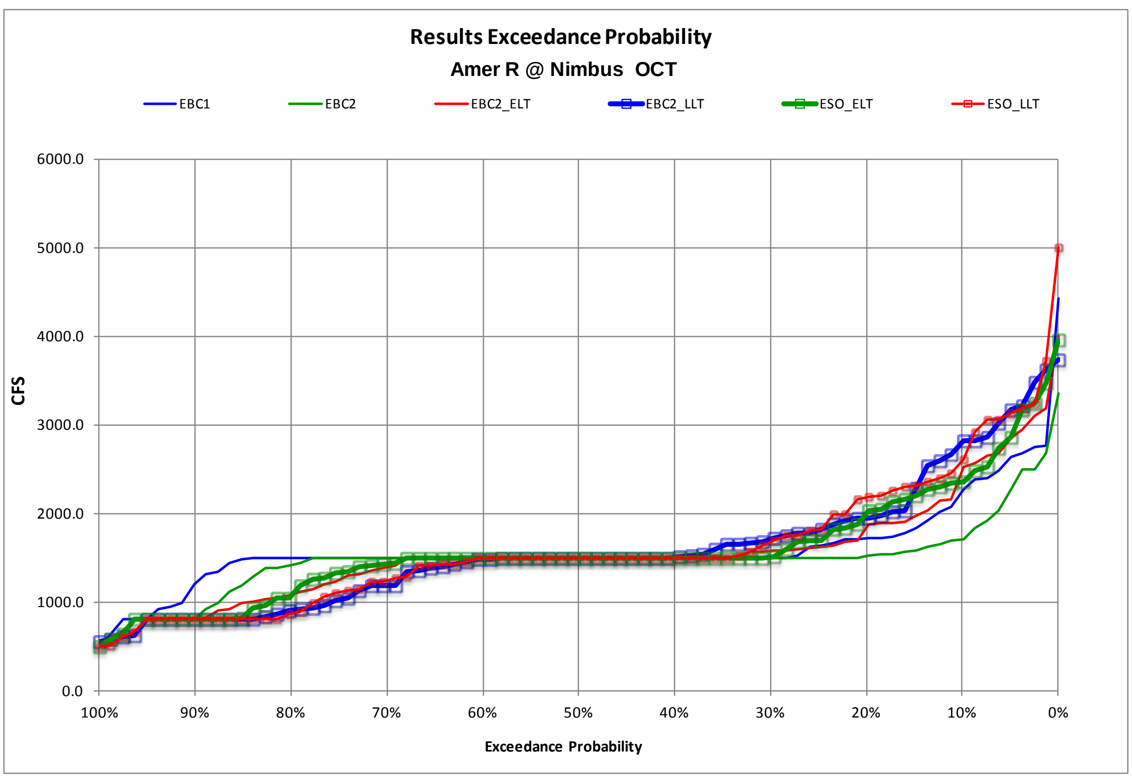


Figure 5C.5.2-148. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the American River below Nimbus Dam, October

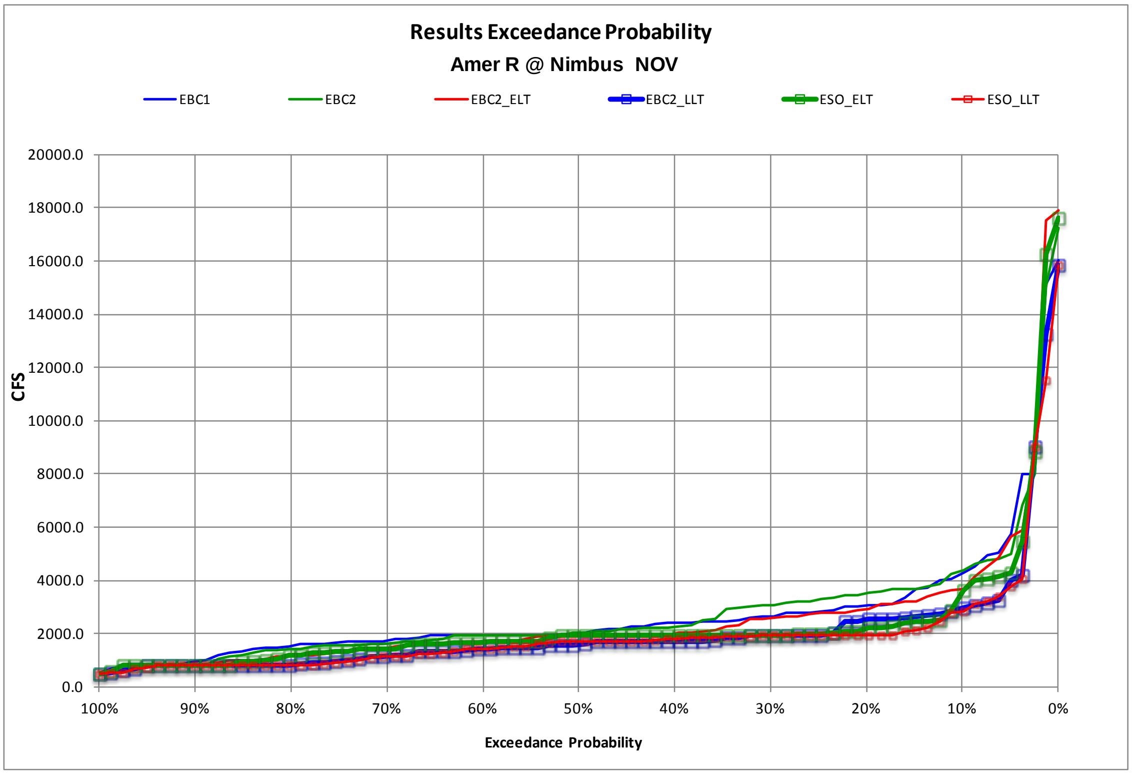


Figure 5C.5.2-149. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the American River below Nimbus Dam, November

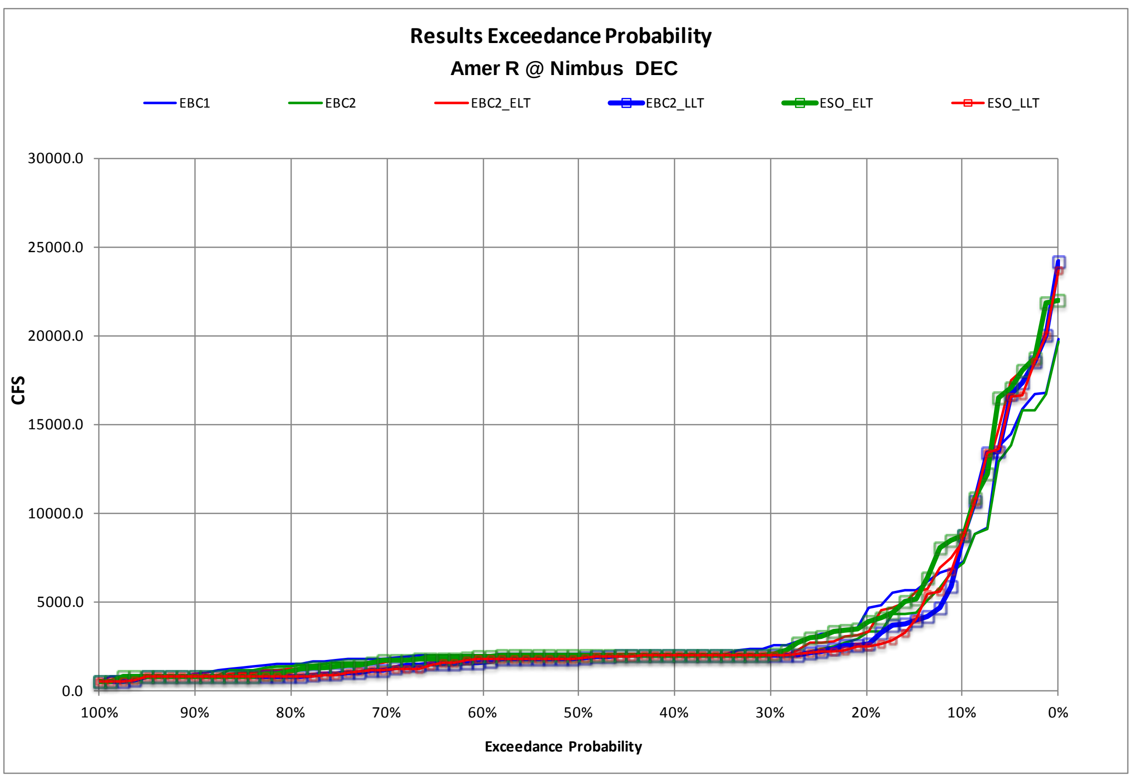


Figure 5C.5.2-150. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the American River below Nimbus Dam, December

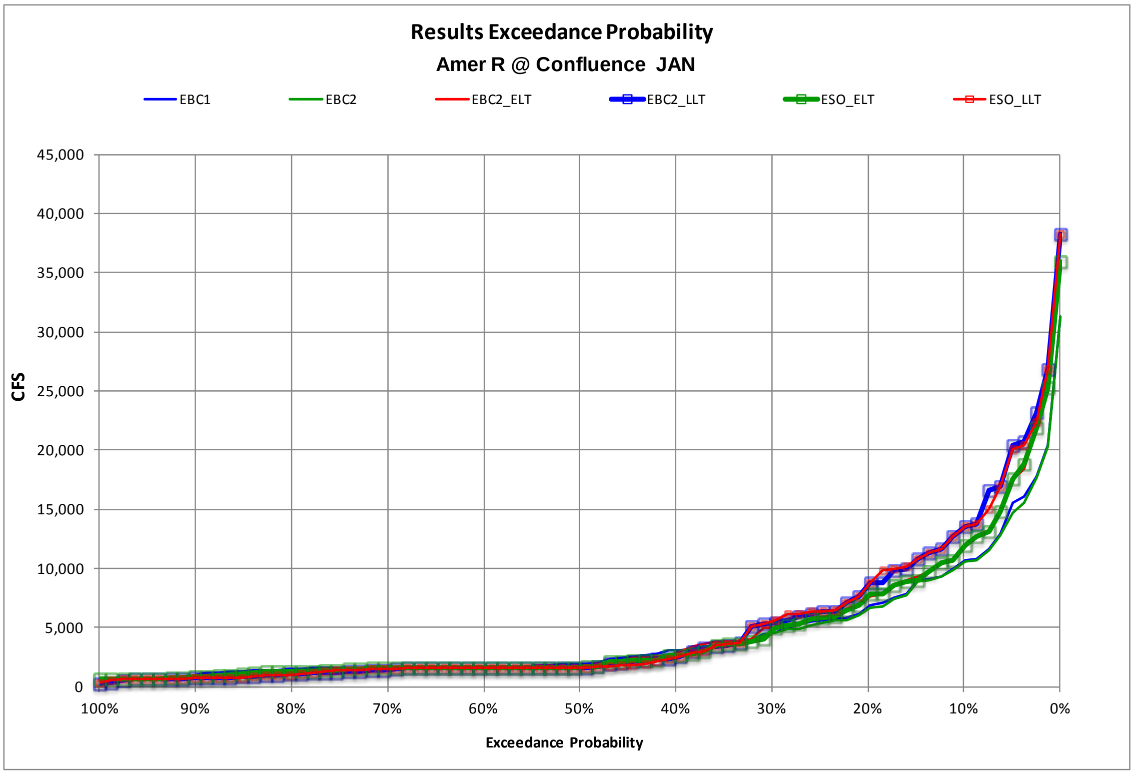


Figure 5C.5.2-151. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the American River at the Confluence with the Sacramento River, January

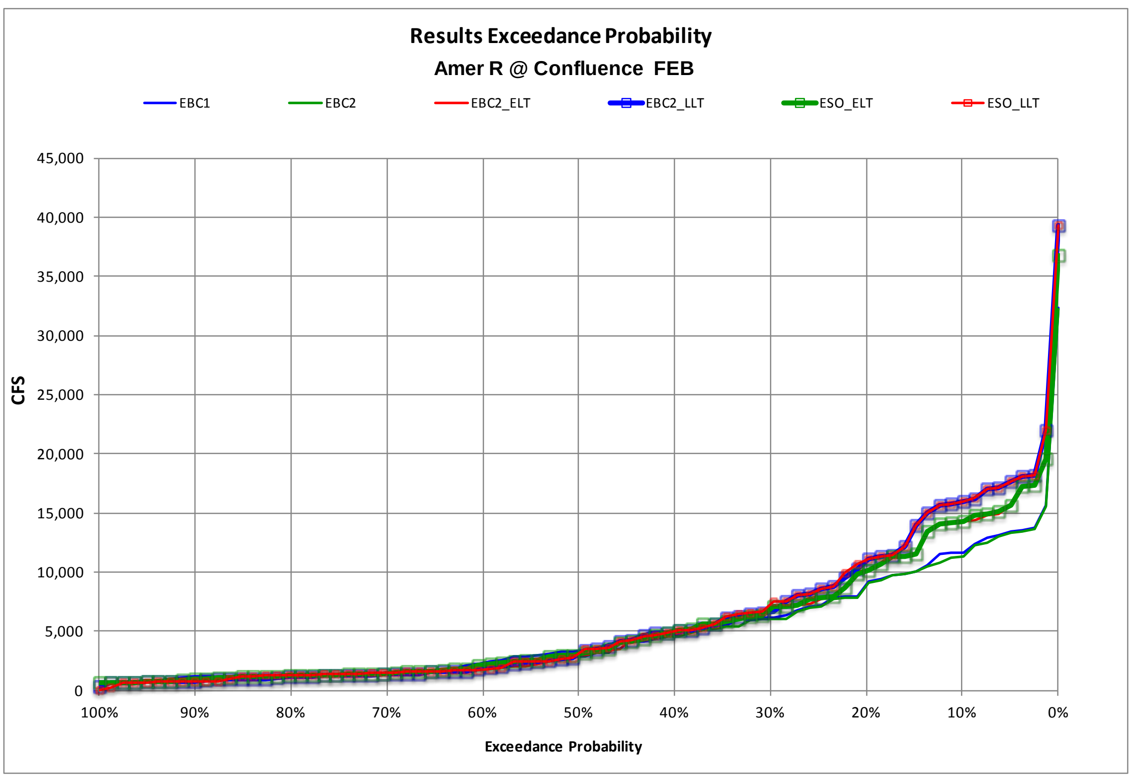


Figure 5C.5.2-152. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the American River at the Confluence with the Sacramento River, February

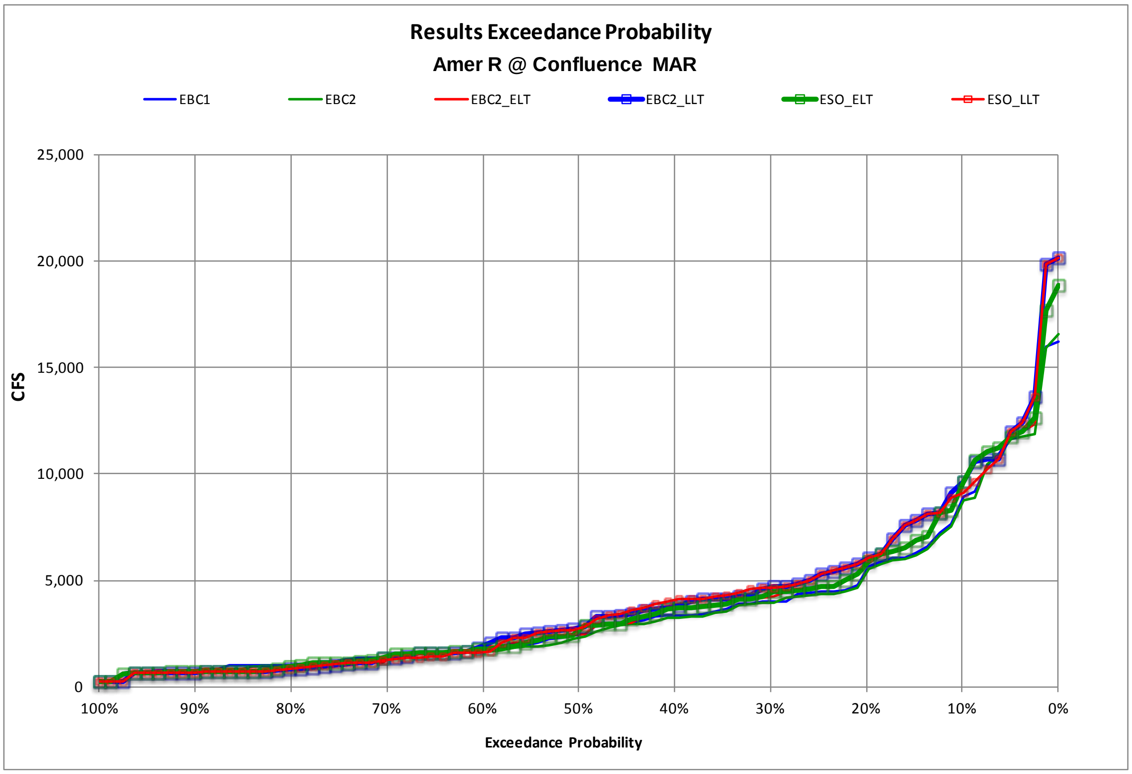


Figure 5C.5.2-153. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the American River at the Confluence with the Sacramento River, March

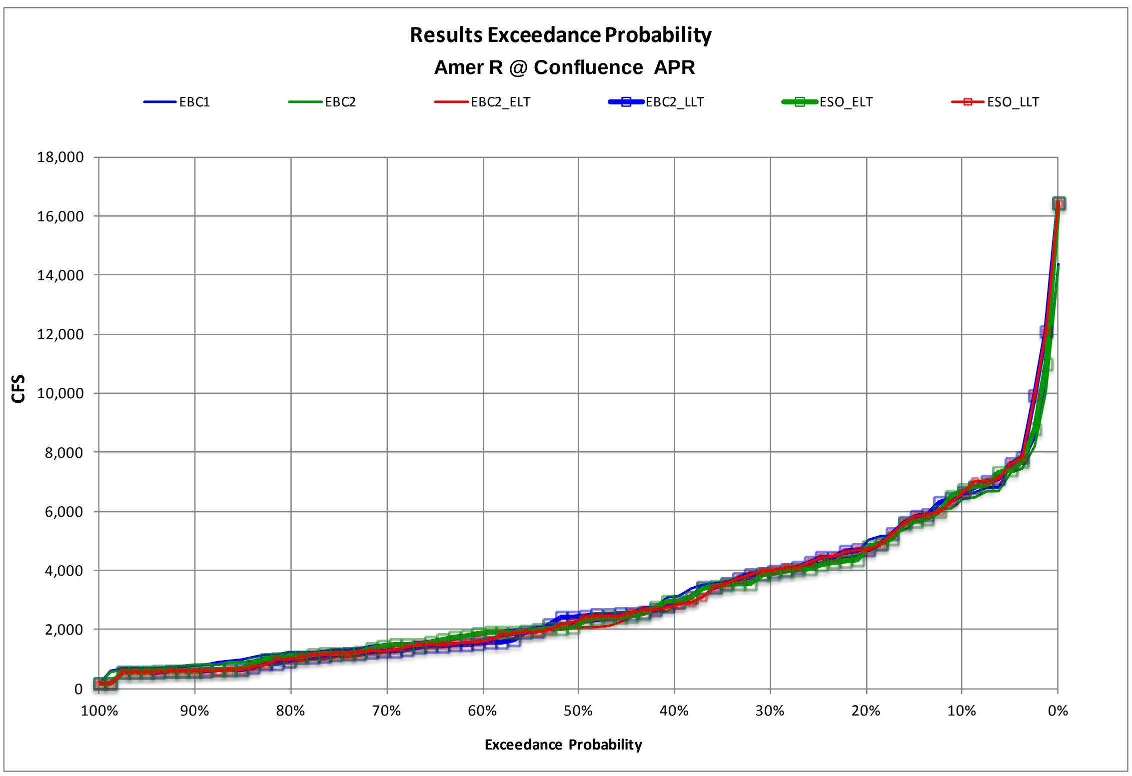
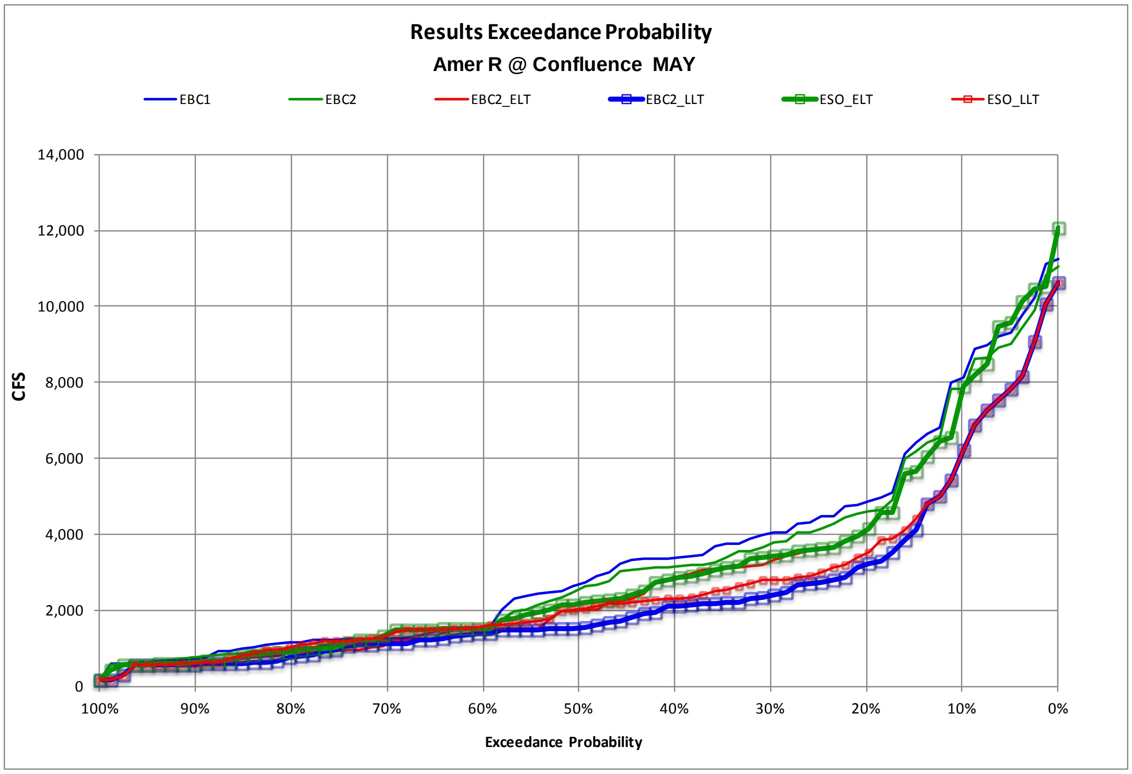
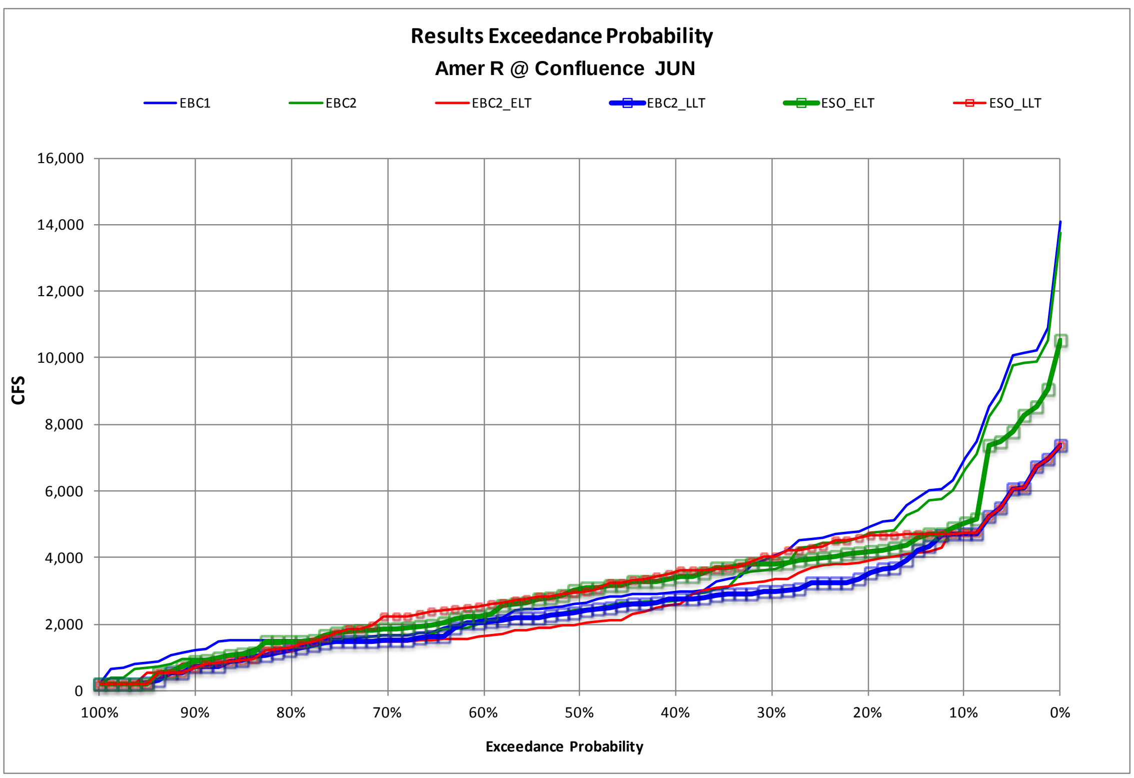


Figure 5C.5.2-154. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the American River at the Confluence with the Sacramento River, April



1
2 **Figure 5C.5.2-155. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in**
3 **the American River at the Confluence with the Sacramento River, May**



4
5 **Figure 5C.5.2-156. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in**
6 **the American River at the Confluence with the Sacramento River, June**

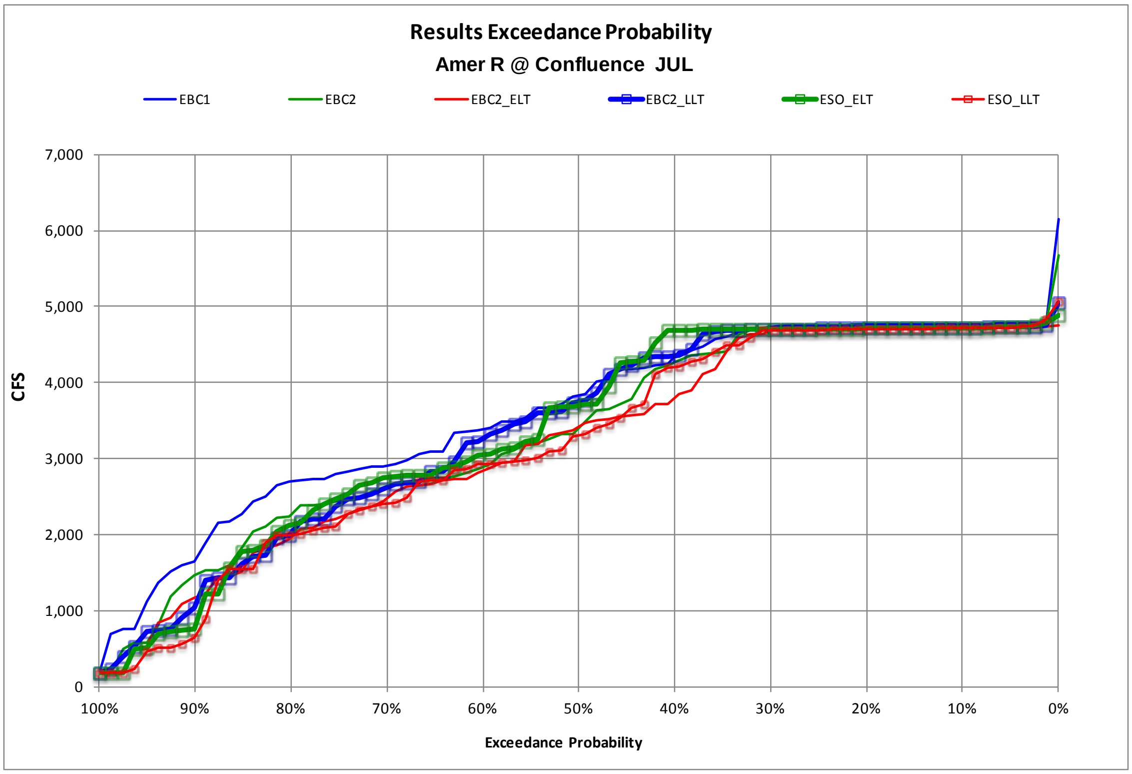


Figure 5C.5.2-157. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the American River at the Confluence with the Sacramento River, July

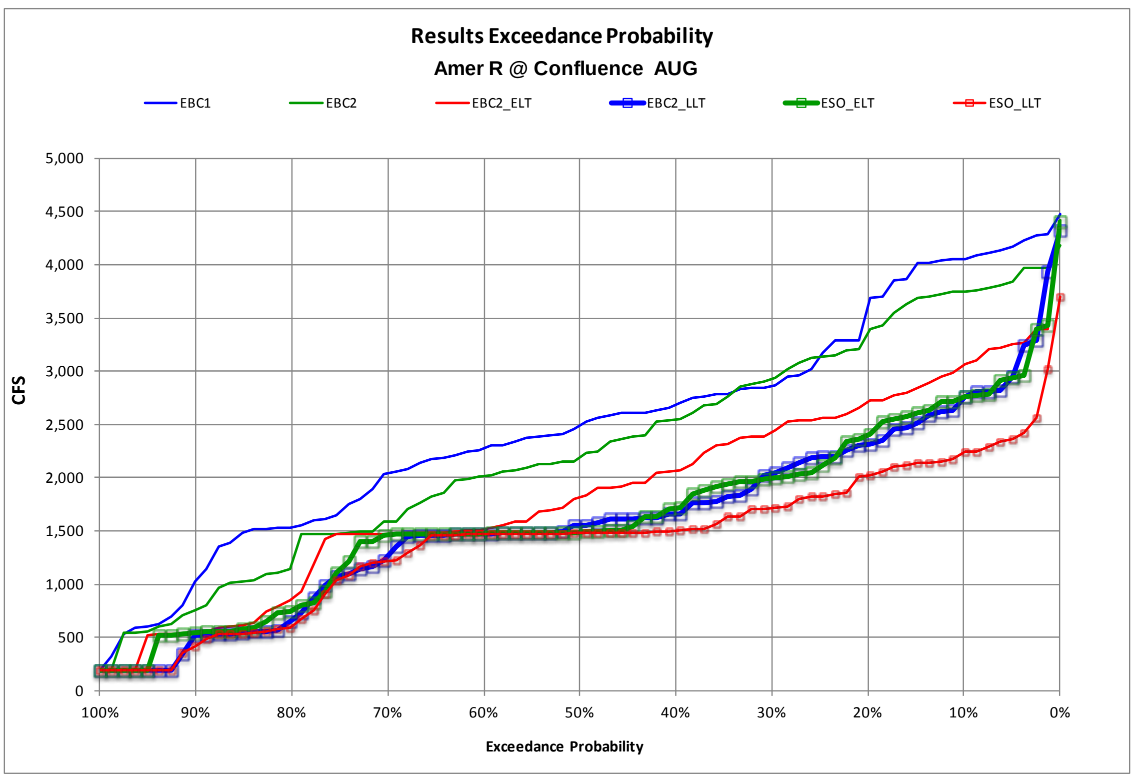


Figure 5C.5.2-158. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the American River at the Confluence with the Sacramento River, August

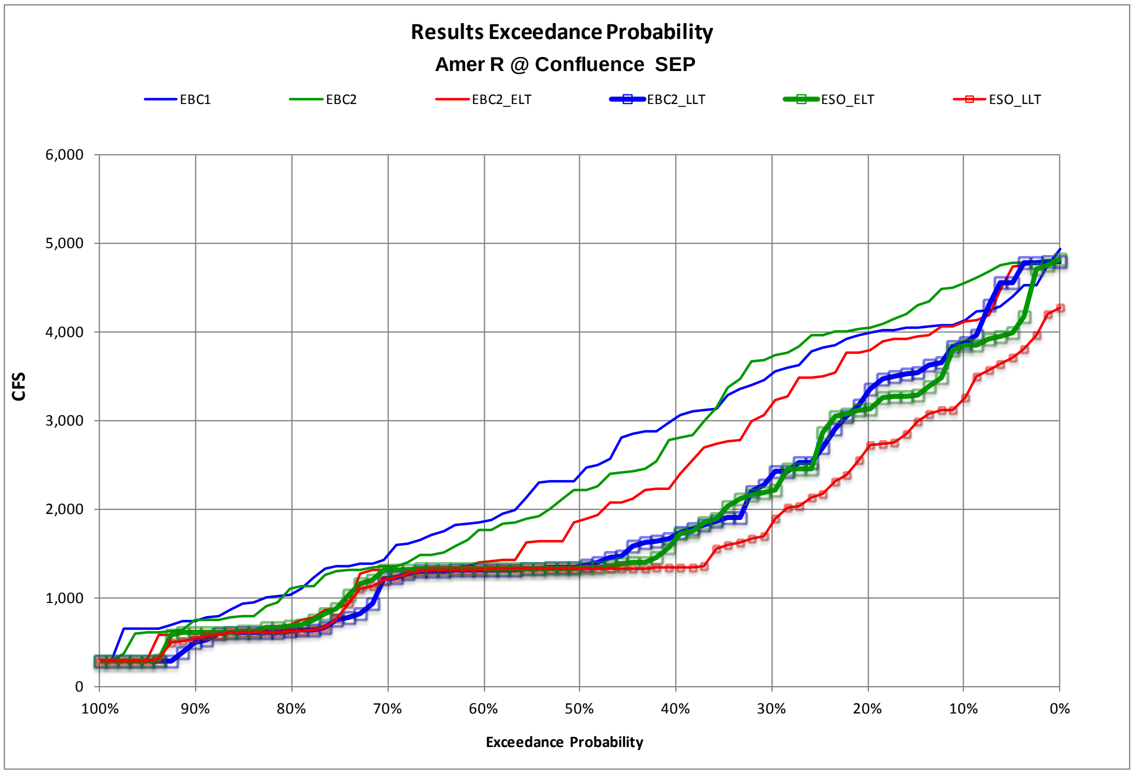


Figure 5C.5.2-159. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the American River at the Confluence with the Sacramento River, September

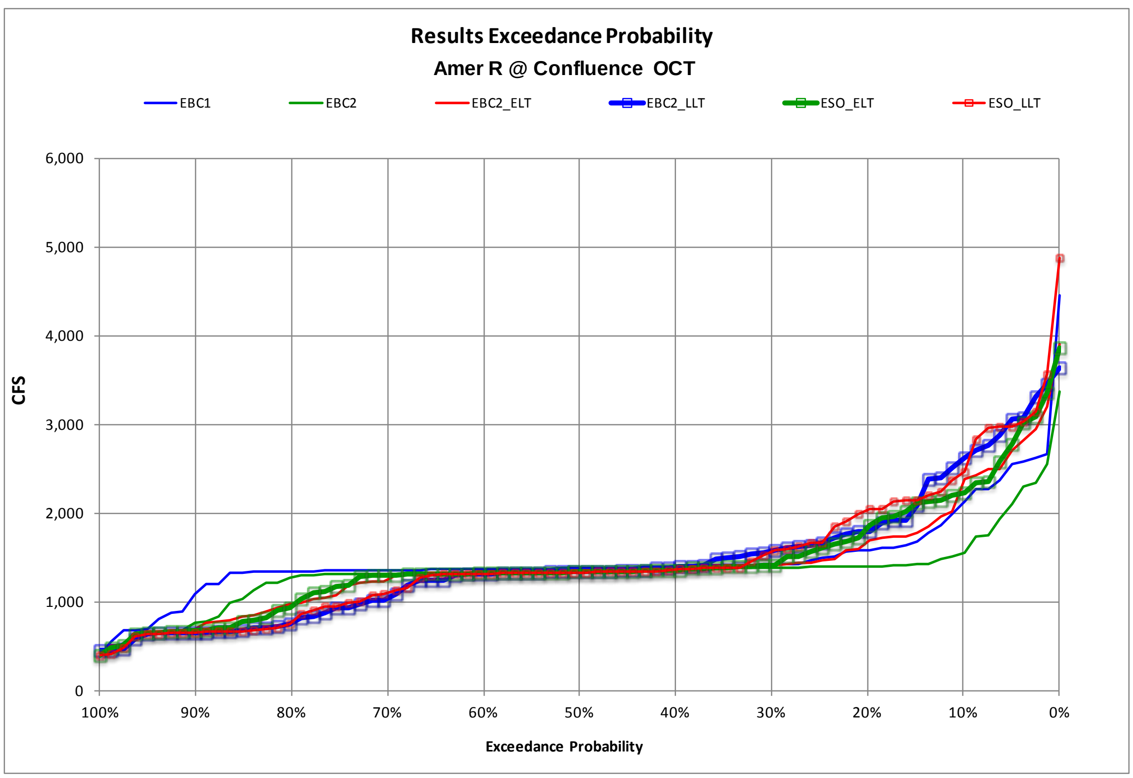


Figure 5C.5.2-160. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the American River at the Confluence with the Sacramento River, October

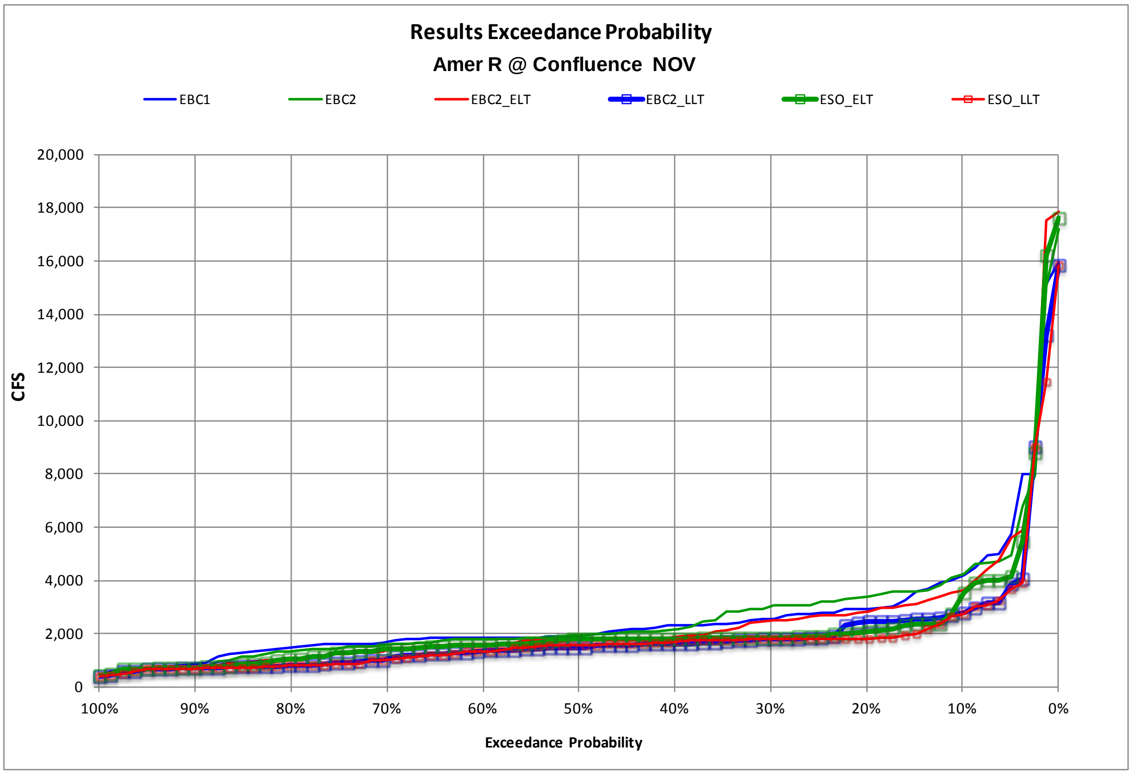


Figure 5C.5.2-161. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the American River at the Confluence with the Sacramento River, November

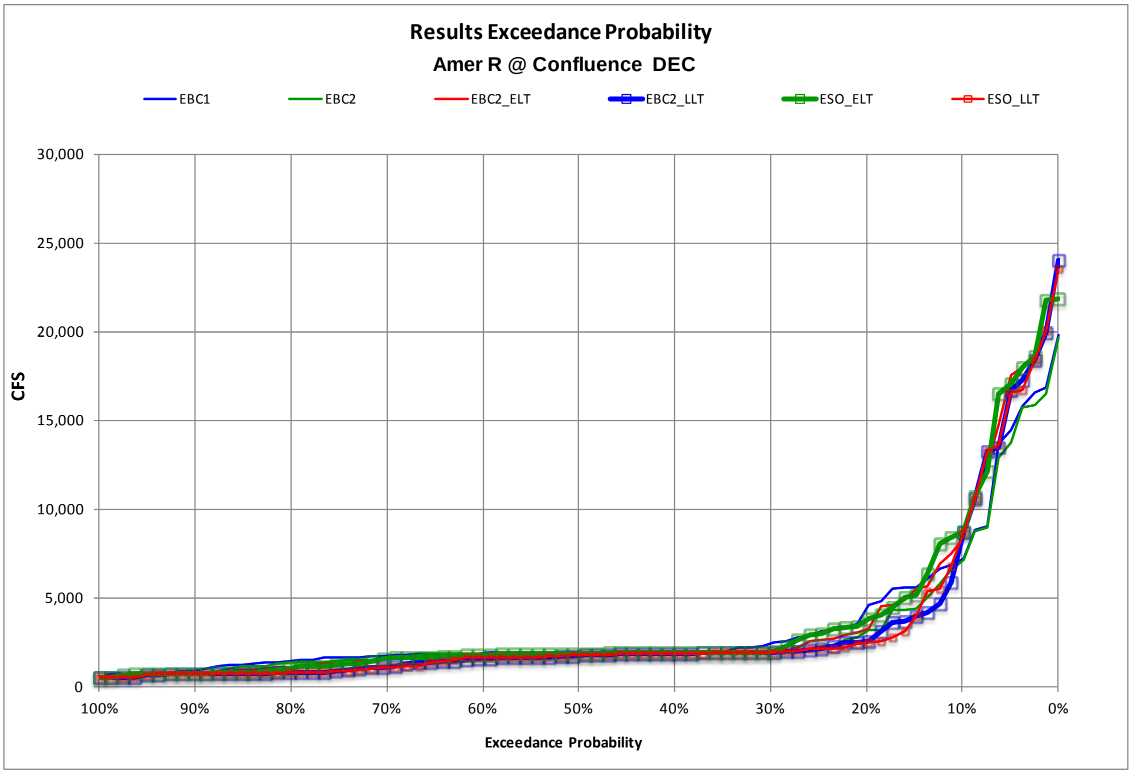


Figure 5C.5.2-162. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the American River at the Confluence with the Sacramento River, December

Table 5C.5.2-216. Mean Monthly Flows (cfs) in the American River at Nimbus Dam for ESO, HOS, and LOS Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	10,103	11,040	10,150	11,005	10,104	11,143
	AN	4,989	5,753	5,100	5,729	5,032	5,969
	BN	2,085	2,026	2,206	2,137	2,123	2,098
	D	1,561	1,417	1,693	1,446	1,532	1,411
	C	1,315	1,258	1,305	1,153	1,346	1,156
	All	4,825	5,184	4,904	5,179	4,836	5,244
Feb	W	10,460	11,107	10,473	11,114	10,485	11,163
	AN	7,484	8,243	7,391	8,223	7,658	8,327
	BN	4,896	4,934	4,889	5,144	4,822	5,029
	D	1,709	1,972	1,738	1,850	1,731	1,888
	C	1,120	1,036	1,151	1,089	1,139	1,075
	All	5,787	6,155	5,787	6,171	5,815	6,189
Mar	W	6,454	6,987	6,454	6,984	6,452	6,982
	AN	5,815	5,811	5,764	5,752	5,813	5,920
	BN	2,648	2,842	2,627	2,802	2,662	2,834
	D	2,277	2,194	2,098	2,240	2,229	2,200
	C	868	872	867	865	833	867
	All	3,976	4,160	3,926	4,153	3,962	4,174
Apr	W	5,368	5,517	5,368	5,522	5,366	5,510
	AN	3,353	3,301	3,352	3,303	3,352	3,321
	BN	3,141	2,952	3,102	2,976	3,092	2,995
	D	1,800	1,884	1,814	1,817	1,785	1,913
	C	1,244	1,270	1,199	1,251	1,290	1,278
	All	3,306	3,336	3,296	3,324	3,300	3,351
May	W	5,672	4,674	5,672	4,603	5,672	4,654
	AN	3,259	2,775	3,203	2,713	3,256	2,758
	BN	2,658	2,381	2,461	2,009	2,662	2,435
	D	1,711	2,029	1,699	1,863	1,730	1,957
	C	1,332	1,002	1,129	1,005	1,018	1,011
	All	3,300	2,886	3,226	2,756	3,258	2,873
Jun	W	4,760	4,373	4,546	3,912	4,771	4,472
	AN	3,451	3,597	2,795	2,877	3,414	3,605
	BN	3,089	3,517	2,420	3,042	3,465	4,040
	D	3,131	2,815	2,320	2,573	3,109	2,743
	C	1,289	1,226	1,331	1,508	1,334	1,563
	All	3,417	3,311	2,968	2,966	3,481	3,466
Jul	W	3,972	3,706	3,875	3,802	3,956	3,729
	AN	4,644	4,738	4,794	4,612	4,646	4,696
	BN	4,647	4,198	4,549	4,064	4,491	3,866
	D	3,142	2,771	3,147	2,767	3,349	2,812
	C	1,693	2,070	1,514	1,966	2,027	1,663
	All	3,670	3,496	3,619	3,470	3,733	3,390

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Aug	W	2,381	2,118	2,512	2,236	2,411	2,122
	AN	2,086	1,971	2,334	2,070	2,097	1,971
	BN	2,197	1,757	2,718	2,310	2,243	1,793
	D	1,412	1,369	1,779	1,539	1,484	1,346
	C	1,088	855	948	1,021	948	860
	All	1,905	1,685	2,131	1,893	1,919	1,689
Sep	W	3,361	3,026	3,730	3,604	2,623	1,960
	AN	2,187	1,819	2,447	2,038	1,775	1,515
	BN	1,492	1,377	1,542	1,533	1,504	1,370
	D	1,360	1,228	1,359	1,315	1,342	1,170
	C	703	662	718	640	916	705
	All	2,042	1,827	2,207	2,085	1,777	1,437
Oct	W	1,594	1,491	1,665	1,448	1,618	1,557
	AN	1,546	1,663	1,596	1,484	1,520	1,589
	BN	1,765	2,001	1,749	1,769	1,792	2,062
	D	1,414	1,430	1,538	1,319	1,527	1,449
	C	1,679	1,650	1,670	1,576	1,655	1,531
	All	1,589	1,613	1,642	1,498	1,619	1,620
Nov	W	2,984	2,508	3,090	2,522	3,073	2,482
	AN	2,878	2,406	2,978	2,391	2,780	2,284
	BN	1,696	1,593	1,855	1,578	1,708	1,612
	D	1,694	1,494	1,667	1,552	1,707	1,341
	C	1,653	1,490	1,702	1,495	1,737	1,601
	All	2,271	1,965	2,347	1,979	2,302	1,925
Dec	W	6,798	6,090	6,806	6,313	6,901	6,452
	AN	3,030	2,927	3,112	3,045	3,020	2,947
	BN	3,009	2,591	2,950	2,606	3,134	2,806
	D	1,606	1,340	1,609	1,401	1,564	1,416
	C	1,442	1,315	1,487	1,320	1,468	1,318
	All	3,676	3,288	3,688	3,393	3,723	3,460

[a] Positive values indicate higher flows under HOS or LOS than under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of scenarios.

Table 5C.5.2-217. Differences[a] between ESO Scenarios and HOS and LOS Scenarios in Mean Monthly Flows (cfs) in the American River at Nimbus Dam

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	47 (0.5%)	-34 (-0.3%)	0 (0%)	103 (0.9%)
	AN	111 (2.2%)	-24 (-0.4%)	43 (0.9%)	216 (3.8%)
	BN	120 (5.8%)	110 (5.4%)	37 (1.8%)	72 (3.5%)
	D	132 (8.5%)	28 (2%)	-29 (-1.8%)	-7 (-0.5%)
	C	-10 (-0.8%)	-105 (-8.4%)	30 (2.3%)	-102 (-8.1%)
	All	79 (1.6%)	-5 (-0.1%)	11 (0.2%)	60 (1.2%)
Feb	W	13 (0.1%)	7 (0.1%)	25 (0.2%)	56 (0.5%)
	AN	-93 (-1.2%)	-19 (-0.2%)	174 (2.3%)	84 (1%)
	BN	-7 (-0.1%)	209 (4.2%)	-75 (-1.5%)	95 (1.9%)
	D	29 (1.7%)	-122 (-6.2%)	21 (1.2%)	-84 (-4.3%)
	C	32 (2.9%)	53 (5.1%)	20 (1.8%)	39 (3.8%)
	All	0 (0%)	16 (0.3%)	28 (0.5%)	34 (0.5%)
Mar	W	0 (0%)	-3 (0%)	-1 (0%)	-5 (-0.1%)
	AN	-51 (-0.9%)	-59 (-1%)	-3 (0%)	109 (1.9%)
	BN	-21 (-0.8%)	-40 (-1.4%)	14 (0.5%)	-8 (-0.3%)
	D	-178 (-7.8%)	46 (2.1%)	-48 (-2.1%)	6 (0.3%)
	C	-1 (-0.1%)	-7 (-0.8%)	-35 (-4%)	-5 (-0.6%)
	All	-50 (-1.3%)	-7 (-0.2%)	-14 (-0.4%)	14 (0.3%)
Apr	W	0 (0%)	4 (0.1%)	-2 (0%)	-8 (-0.1%)
	AN	-1 (0%)	2 (0.1%)	0 (0%)	20 (0.6%)
	BN	-39 (-1.2%)	24 (0.8%)	-49 (-1.6%)	43 (1.5%)
	D	14 (0.8%)	-67 (-3.6%)	-15 (-0.8%)	29 (1.6%)
	C	-45 (-3.6%)	-19 (-1.5%)	46 (3.7%)	8 (0.6%)
	All	-10 (-0.3%)	-12 (-0.4%)	-6 (-0.2%)	15 (0.5%)
May	W	0 (0%)	-71 (-1.5%)	0 (0%)	-19 (-0.4%)
	AN	-56 (-1.7%)	-62 (-2.2%)	-3 (-0.1%)	-17 (-0.6%)
	BN	-197 (-7.4%)	-371 (-15.6%)	5 (0.2%)	54 (2.3%)
	D	-12 (-0.7%)	-166 (-8.2%)	18 (1.1%)	-72 (-3.6%)
	C	-203 (-15.2%)	3 (0.3%)	-315 (-23.6%)	9 (0.9%)
	All	-74 (-2.2%)	-131 (-4.5%)	-42 (-1.3%)	-14 (-0.5%)
Jun	W	-213 (-4.5%)	-461 (-10.5%)	11 (0.2%)	99 (2.3%)
	AN	-656 (-19%)	-720 (-20%)	-37 (-1.1%)	8 (0.2%)
	BN	-669 (-21.6%)	-476 (-13.5%)	376 (12.2%)	523 (14.9%)
	D	-811 (-25.9%)	-243 (-8.6%)	-22 (-0.7%)	-72 (-2.6%)
	C	42 (3.2%)	282 (23%)	45 (3.5%)	337 (27.5%)
	All	-450 (-13.2%)	-345 (-10.4%)	64 (1.9%)	155 (4.7%)
Jul	W	-97 (-2.4%)	96 (2.6%)	-15 (-0.4%)	23 (0.6%)
	AN	151 (3.2%)	-126 (-2.7%)	2 (0%)	-42 (-0.9%)
	BN	-98 (-2.1%)	-133 (-3.2%)	-156 (-3.4%)	-332 (-7.9%)
	D	5 (0.1%)	-3 (-0.1%)	207 (6.6%)	42 (1.5%)
	C	-179 (-10.6%)	-104 (-5%)	334 (19.7%)	-407 (-19.6%)
	All	-51 (-1.4%)	-27 (-0.8%)	63 (1.7%)	-106 (-3%)

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	131 (5.5%)	118 (5.6%)	30 (1.3%)	4 (0.2%)
	AN	248 (11.9%)	99 (5%)	11 (0.5%)	0 (0%)
	BN	521 (23.7%)	553 (31.5%)	46 (2.1%)	36 (2.1%)
	D	367 (26%)	170 (12.4%)	72 (5.1%)	-23 (-1.7%)
	C	-141 (-12.9%)	166 (19.5%)	-141 (-12.9%)	6 (0.6%)
	All	227 (11.9%)	208 (12.3%)	14 (0.8%)	3 (0.2%)
Sep	W	368 (11%)	577 (19.1%)	-738 (-22%)	-1066 (-35.2%)
	AN	260 (11.9%)	219 (12%)	-412 (-18.8%)	-304 (-16.7%)
	BN	50 (3.4%)	156 (11.3%)	12 (0.8%)	-7 (-0.5%)
	D	-1 (-0.1%)	87 (7.1%)	-18 (-1.3%)	-58 (-4.7%)
	C	15 (2.2%)	-21 (-3.2%)	213 (30.3%)	44 (6.6%)
	All	165 (8.1%)	258 (14.1%)	-265 (-13%)	-390 (-21.3%)
Oct	W	71 (4.4%)	-43 (-2.9%)	24 (1.5%)	66 (4.4%)
	AN	49 (3.2%)	-179 (-10.8%)	-26 (-1.7%)	-74 (-4.4%)
	BN	-16 (-0.9%)	-232 (-11.6%)	27 (1.5%)	61 (3%)
	D	124 (8.8%)	-111 (-7.8%)	112 (7.9%)	19 (1.4%)
	C	-10 (-0.6%)	-74 (-4.5%)	-25 (-1.5%)	-119 (-7.2%)
	All	53 (3.3%)	-115 (-7.1%)	30 (1.9%)	7 (0.5%)
Nov	W	106 (3.5%)	14 (0.6%)	89 (3%)	-27 (-1.1%)
	AN	101 (3.5%)	-15 (-0.6%)	-98 (-3.4%)	-122 (-5.1%)
	BN	159 (9.4%)	-15 (-0.9%)	12 (0.7%)	19 (1.2%)
	D	-27 (-1.6%)	57 (3.8%)	12 (0.7%)	-153 (-10.2%)
	C	49 (3%)	6 (0.4%)	84 (5.1%)	112 (7.5%)
	All	76 (3.4%)	13 (0.7%)	31 (1.4%)	-40 (-2.1%)
Dec	W	8 (0.1%)	223 (3.7%)	103 (1.5%)	362 (5.9%)
	AN	82 (2.7%)	117 (4%)	-10 (-0.3%)	20 (0.7%)
	BN	-59 (-2%)	16 (0.6%)	125 (4.2%)	215 (8.3%)
	D	3 (0.2%)	61 (4.6%)	-42 (-2.6%)	76 (5.7%)
	C	45 (3.1%)	5 (0.4%)	27 (1.8%)	3 (0.3%)
	All	11 (0.3%)	105 (3.2%)	47 (1.3%)	172 (5.2%)

[a] Positive values indicate higher flows under HOS or LOS than under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of scenarios.

Table 5C.5.2-218. Mean Monthly Flows (cfs) in the American River at the Confluence with the Sacramento River for ESO, HOS, and LOS Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	10,021	10,964	10,068	10,930	10,020	11,064
	AN	4,944	5,709	5,054	5,683	4,987	5,925
	BN	1,997	1,941	2,117	2,051	2,033	2,011
	D	1,477	1,336	1,608	1,363	1,449	1,331
	C	1,226	1,176	1,215	1,065	1,256	1,068
	All	4,745	5,109	4,824	5,103	4,756	5,167
Feb	W	10,313	10,952	10,326	10,962	10,338	11,007
	AN	7,412	8,163	7,318	8,144	7,585	8,244
	BN	4,824	4,862	4,815	5,069	4,749	4,956
	D	1,621	1,886	1,648	1,763	1,642	1,802
	C	1,030	956	1,062	1,003	1,050	989
	All	5,685	6,051	5,684	6,067	5,713	6,083
Mar	W	6,303	6,831	6,303	6,829	6,302	6,826
	AN	5,692	5,681	5,642	5,622	5,688	5,789
	BN	2,527	2,721	2,506	2,679	2,542	2,711
	D	2,187	2,102	2,009	2,150	2,139	2,109
	C	764	782	763	762	738	764
	All	3,855	4,038	3,804	4,029	3,842	4,049
Apr	W	5,164	5,309	5,164	5,313	5,162	5,301
	AN	3,132	3,081	3,132	3,084	3,132	3,100
	BN	2,950	2,760	2,912	2,784	2,901	2,803
	D	1,588	1,673	1,603	1,606	1,573	1,703
	C	1,040	1,075	995	1,047	1,089	1,075
	All	3,100	3,130	3,090	3,117	3,095	3,144
May	W	5,414	4,414	5,414	4,343	5,414	4,395
	AN	3,022	2,540	2,967	2,478	3,019	2,522
	BN	2,413	2,138	2,217	1,766	2,419	2,192
	D	1,480	1,797	1,468	1,632	1,499	1,725
	C	1,129	800	927	802	819	807
	All	3,061	2,648	2,987	2,517	3,020	2,633
Jun	W	4,445	4,068	4,231	3,607	4,456	4,166
	AN	3,158	3,309	2,502	2,589	3,120	3,316
	BN	2,803	3,234	2,137	2,762	3,180	3,756
	D	2,855	2,536	2,044	2,295	2,832	2,464
	C	1,044	994	1,088	1,270	1,101	1,322
	All	3,129	3,028	2,680	2,684	3,195	3,182
Jul	W	3,663	3,400	3,567	3,500	3,647	3,422
	AN	4,348	4,441	4,505	4,321	4,351	4,400
	BN	4,356	3,902	4,263	3,773	4,196	3,566
	D	2,852	2,484	2,864	2,483	3,059	2,526
	C	1,439	1,829	1,259	1,720	1,782	1,419
	All	3,378	3,207	3,331	3,183	3,442	3,100

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Aug	W	2,106	1,845	2,237	1,963	2,136	1,849
	AN	1,807	1,691	2,054	1,791	1,819	1,692
	BN	1,918	1,482	2,439	2,036	1,966	1,521
	D	1,149	1,112	1,516	1,279	1,219	1,086
	C	893	649	734	818	727	661
	All	1,643	1,425	1,867	1,632	1,653	1,429
Sep	W	3,151	2,819	3,519	3,395	2,413	1,753
	AN	1,980	1,613	2,238	1,831	1,568	1,309
	BN	1,290	1,179	1,335	1,330	1,302	1,172
	D	1,167	1,035	1,162	1,121	1,148	978
	C	535	494	536	471	749	539
	All	1,844	1,631	2,005	1,887	1,579	1,241
Oct	W	1,458	1,357	1,528	1,312	1,485	1,429
	AN	1,421	1,539	1,468	1,356	1,397	1,468
	BN	1,617	1,862	1,602	1,618	1,647	1,927
	D	1,271	1,289	1,393	1,176	1,385	1,310
	C	1,537	1,521	1,527	1,438	1,514	1,395
	All	1,451	1,479	1,502	1,359	1,482	1,488
Nov	W	2,912	2,437	3,017	2,452	3,001	2,410
	AN	2,780	2,308	2,880	2,294	2,682	2,186
	BN	1,598	1,492	1,757	1,480	1,609	1,511
	D	1,594	1,395	1,566	1,453	1,606	1,241
	C	1,534	1,371	1,583	1,377	1,617	1,484
	All	2,177	1,872	2,253	1,886	2,208	1,832
Dec	W	6,739	6,035	6,748	6,261	6,841	6,397
	AN	2,950	2,852	3,031	2,969	2,941	2,873
	BN	2,928	2,511	2,867	2,526	3,053	2,726
	D	1,527	1,264	1,530	1,324	1,485	1,341
	C	1,346	1,222	1,390	1,227	1,371	1,224
	All	3,600	3,216	3,612	3,321	3,647	3,388

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of scenarios.

Table 5C.5.2-219. Differences[a] between ESO and EBC Scenarios in Mean Monthly Flows (cfs) in the American River at the Confluence with the Sacramento River

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	47 (0.5%)	-34 (-0.3%)	-1 (0%)	100 (0.9%)
	AN	111 (2.2%)	-26 (-0.5%)	43 (0.9%)	216 (3.8%)
	BN	121 (6%)	110 (5.7%)	36 (1.8%)	70 (3.6%)
	D	132 (8.9%)	27 (2.1%)	-28 (-1.9%)	-5 (-0.4%)
	C	-10 (-0.8%)	-111 (-9.4%)	30 (2.4%)	-108 (-9.2%)
	All	79 (1.7%)	-6 (-0.1%)	10 (0.2%)	58 (1.1%)
Feb	W	12 (0.1%)	10 (0.1%)	25 (0.2%)	55 (0.5%)
	AN	-94 (-1.3%)	-19 (-0.2%)	173 (2.3%)	81 (1%)
	BN	-8 (-0.2%)	208 (4.3%)	-75 (-1.6%)	94 (1.9%)
	D	28 (1.7%)	-123 (-6.5%)	22 (1.4%)	-84 (-4.5%)
	C	32 (3.1%)	47 (4.9%)	20 (1.9%)	33 (3.4%)
	All	0 (0%)	16 (0.3%)	28 (0.5%)	32 (0.5%)
Mar	W	0 (0%)	-3 (0%)	-2 (0%)	-5 (-0.1%)
	AN	-50 (-0.9%)	-59 (-1%)	-4 (-0.1%)	108 (1.9%)
	BN	-21 (-0.8%)	-42 (-1.5%)	15 (0.6%)	-9 (-0.3%)
	D	-179 (-8.2%)	47 (2.2%)	-48 (-2.2%)	7 (0.3%)
	C	-1 (-0.2%)	-20 (-2.6%)	-26 (-3.4%)	-18 (-2.3%)
	All	-51 (-1.3%)	-9 (-0.2%)	-13 (-0.3%)	11 (0.3%)
Apr	W	0 (0%)	4 (0.1%)	-2 (0%)	-8 (-0.1%)
	AN	-1 (0%)	3 (0.1%)	0 (0%)	18 (0.6%)
	BN	-39 (-1.3%)	25 (0.9%)	-49 (-1.7%)	43 (1.6%)
	D	16 (1%)	-68 (-4.1%)	-15 (-0.9%)	29 (1.8%)
	C	-45 (-4.3%)	-28 (-2.6%)	49 (4.7%)	0 (0%)
	All	-10 (-0.3%)	-13 (-0.4%)	-5 (-0.2%)	14 (0.4%)
May	W	0 (0%)	-71 (-1.6%)	0 (0%)	-19 (-0.4%)
	AN	-56 (-1.8%)	-62 (-2.4%)	-3 (-0.1%)	-18 (-0.7%)
	BN	-196 (-8.1%)	-372 (-17.4%)	6 (0.2%)	54 (2.5%)
	D	-13 (-0.9%)	-165 (-9.2%)	19 (1.3%)	-73 (-4%)
	C	-203 (-18%)	3 (0.3%)	-310 (-27.5%)	8 (1%)
	All	-74 (-2.4%)	-131 (-4.9%)	-41 (-1.3%)	-14 (-0.5%)
Jun	W	-213 (-4.8%)	-460 (-11.3%)	11 (0.3%)	99 (2.4%)
	AN	-656 (-20.8%)	-720 (-21.8%)	-37 (-1.2%)	8 (0.2%)
	BN	-666 (-23.8%)	-472 (-14.6%)	377 (13.4%)	522 (16.2%)
	D	-810 (-28.4%)	-241 (-9.5%)	-22 (-0.8%)	-72 (-2.8%)
	C	44 (4.2%)	276 (27.7%)	57 (5.5%)	328 (33%)
	All	-449 (-14.3%)	-344 (-11.4%)	66 (2.1%)	154 (5.1%)
Jul	W	-95 (-2.6%)	100 (2.9%)	-15 (-0.4%)	22 (0.6%)
	AN	157 (3.6%)	-120 (-2.7%)	2 (0.1%)	-42 (-0.9%)
	BN	-92 (-2.1%)	-129 (-3.3%)	-160 (-3.7%)	-337 (-8.6%)
	D	12 (0.4%)	-1 (0%)	207 (7.3%)	42 (1.7%)
	C	-180 (-12.5%)	-109 (-6%)	342 (23.8%)	-411 (-22.5%)
	All	-47 (-1.4%)	-24 (-0.8%)	64 (1.9%)	-107 (-3.3%)

Month	Water-Year Type[b]	Scenarios[c] ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	132 (6.3%)	117 (6.4%)	31 (1.5%)	4 (0.2%)
	AN	247 (13.7%)	100 (5.9%)	11 (0.6%)	1 (0%)
	BN	521 (27.2%)	554 (37.4%)	48 (2.5%)	39 (2.6%)
	D	367 (31.9%)	167 (15.1%)	70 (6.1%)	-25 (-2.3%)
	C	-159 (-17.8%)	168 (25.9%)	-166 (-18.6%)	12 (1.8%)
	All	224 (13.6%)	208 (14.6%)	11 (0.6%)	4 (0.3%)
Sep	W	367 (11.7%)	576 (20.4%)	-738 (-23.4%)	-1066 (-37.8%)
	AN	257 (13%)	218 (13.5%)	-412 (-20.8%)	-304 (-18.9%)
	BN	45 (3.5%)	151 (12.8%)	12 (0.9%)	-7 (-0.6%)
	D	-5 (-0.4%)	86 (8.3%)	-19 (-1.6%)	-57 (-5.5%)
	C	1 (0.2%)	-23 (-4.6%)	214 (40%)	45 (9%)
	All	161 (8.7%)	256 (15.7%)	-265 (-14.4%)	-390 (-23.9%)
Oct	W	70 (4.8%)	-45 (-3.3%)	27 (1.9%)	72 (5.3%)
	AN	47 (3.3%)	-183 (-11.9%)	-24 (-1.7%)	-71 (-4.6%)
	BN	-16 (-1%)	-244 (-13.1%)	30 (1.8%)	65 (3.5%)
	D	121 (9.5%)	-113 (-8.7%)	113 (8.9%)	21 (1.6%)
	C	-11 (-0.7%)	-83 (-5.5%)	-23 (-1.5%)	-126 (-8.3%)
	All	51 (3.5%)	-119 (-8.1%)	32 (2.2%)	10 (0.7%)
Nov	W	105 (3.6%)	15 (0.6%)	89 (3%)	-27 (-1.1%)
	AN	100 (3.6%)	-14 (-0.6%)	-98 (-3.5%)	-122 (-5.3%)
	BN	159 (9.9%)	-12 (-0.8%)	11 (0.7%)	19 (1.3%)
	D	-29 (-1.8%)	58 (4.2%)	12 (0.7%)	-153 (-11%)
	C	49 (3.2%)	6 (0.5%)	84 (5.5%)	113 (8.2%)
	All	76 (3.5%)	14 (0.8%)	31 (1.4%)	-40 (-2.2%)
Dec	W	9 (0.1%)	225 (3.7%)	102 (1.5%)	362 (6%)
	AN	81 (2.8%)	117 (4.1%)	-9 (-0.3%)	21 (0.7%)
	BN	-61 (-2.1%)	16 (0.6%)	125 (4.3%)	215 (8.6%)
	D	3 (0.2%)	60 (4.8%)	-42 (-2.8%)	77 (6.1%)
	C	44 (3.3%)	4 (0.4%)	25 (1.9%)	2 (0.2%)
	All	12 (0.3%)	105 (3.3%)	47 (1.3%)	172 (5.3%)

[a] Positive values indicate higher flows under HOS or LOS than under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of scenarios.

An additional analysis was conducted to determine the probability of exceeding the year-round 1,750 cfs instream flow threshold established by NMFS (2009, in prep.) for maintaining critical habitat features in the American River below Nimbus Dam (Table 5C.5.2-9). Exceedance frequencies for each model scenario are presented in Table 5C.5.2-220 and differences between pairs of scenarios are presented in Table 5C.5.2-221. The exceedances of the 1,750 cfs flow thresholds under ESO_ELT would be similar to exceedances under EBC2_ELT in all water-year types except critical years, in which exceedance would be 36.4% higher under the ESO_ELT. The exceedances of the 1,750 cfs flow thresholds under ESO_LLT would be similar to exceedances under EBC2_LLT in wet, above normal, and below normal water years, and higher in dry and critical years by 7% to 10%. These results indicate the ESO would be beneficial to year-round critical habitat feature maintenance in dry and critical years and would have no effect in other water years.

Exceedances of the year-round 1,750 cfs threshold under HOS and LOS scenarios would generally be similar to or greater than those under ESO, except in critical water years under HOS_ELT, in which the exceedance would be 14.1% lower, and in dry water years under HOS_LLT (Table 5C.5.2-222, Table 5C.5.2-223). However, these values would be comparable to or greater than exceedances under EBC2 scenarios (Table 5C.5.2-220). Therefore, these results indicate that HOS and LOS scenarios would not negatively affect the maintenance of year-round critical habitat features in the American River.

Table 5C.5.2-220. Percentage of Months that Exceed the Year-Round 1,750 cfs Flow Threshold in the American River below Nimbus Dam under EBC and ESO Scenarios

Water-Year Type[a]	Scenario[b]					
	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
W	90.4	88.1	88.5	85.3	86.5	83.7
AN	85.3	83.9	81.8	71.2	81.1	71.2
BN	71.9	66.5	68.9	63.3	66.9	62.0
D	51.6	46.5	42.3	38.8	43.5	41.6
C	20.8	16.0	16.7	19.5	22.7	21.4
All	67.8	64.1	63.5	59.0	62.9	59.2

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of scenarios.

Table 5C.5.2-221. Differences[a] between EBC and ESO Scenarios in the Percentage of Months that Exceed the Year-Round 1,750 cfs Flow Threshold in the American River below Nimbus Dam

Water-Year Type[b]	Scenarios[c]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
W	-3.8 (-4.3%)	-6.7 (-7.4%)	-1.6 (-1.8%)	-1.6 (-1.8%)	-1.9 (-2.2%)	-1.6 (-1.9%)
AN	-4.3 (-5%)	-14.1 (-16.5%)	-2.9 (-3.4%)	-2.9 (-3.4%)	-0.8 (-0.9%)	0 (0%)
BN	-5 (-6.9%)	-9.8 (-13.6%)	0.4 (0.6%)	0.4 (0.6%)	-2 (-2.9%)	-1.2 (-1.9%)
D	-8.2 (-15.8%)	-10 (-19.4%)	-3.1 (-6.6%)	-3.1 (-6.6%)	1.1 (2.7%)	2.8 (7.2%)
C	1.9 (9.1%)	0.6 (2.9%)	6.8 (42.3%)	6.8 (42.3%)	6.1 (36.4%)	1.9 (10.0%)
All	-4.9 (-7.2%)	-8.6 (-12.6%)	-1.2 (-1.9%)	-1.2 (-1.9%)	-0.6 (-1%)	0.2 (0.3%)

[a] Positive values indicate a higher percentage of months exceeding the flow threshold in the ESO than in EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of scenarios.

Table 5C.5.2-222. Percentage of Months that Exceed the Year-Round 1,750 cfs Flow Threshold in the American River below Nimbus Dam under ESO, HOS, and LOS Scenarios

Water-Year Type[a]	Scenario[b]					
	ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
W	86.5	83.7	88.1	83.7	85.6	78.8
AN	81.1	71.2	84.1	70.5	77.3	71.2
BN	66.9	62.0	66.3	60.8	68.7	66.3
D	43.5	41.6	41.1	37.4	45.3	39.7
C	22.7	21.4	19.5	22.1	24.7	22.1
All	62.9	59.2	62.7	58.1	63.1	58.1

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of scenarios.

Table 5C.5.2-223. Differences[a] between the ESO Scenarios and HOS and LOS Scenarios in the Percentage of Months that Exceed the Year-Round 1,750 cfs Flow Threshold in the American River below Nimbus Dam

Water-Year Type[b]	Scenarios[c]			
	ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
W	1.6 (1.8%)	0 (0%)	-0.9 (-1%)	-4.9 (-5.9%)
AN	3 (3.7%)	-0.7 (-1%)	-3.8 (-4.7%)	0 (0%)
BN	-0.6 (-0.9%)	-1.2 (-1.9%)	1.8 (2.7%)	4.3 (6.9%)
D	-2.4 (-5.5%)	-4.2 (-10.1%)	1.8 (4.1%)	-1.9 (-4.6%)
C	-3.2 (-14.1%)	0.7 (3.3%)	2 (8.8%)	0.7 (3.3%)
All	-0.2 (-0.3%)	-1.1 (-1.9%)	0.2 (0.3%)	-1.1 (-1.9%)

[a] Positive values indicate a higher percentage of months that exceed the flow threshold in the HOS or LOS than in ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of scenarios.

Water Temperature

Results of water temperature simulation analyses (Reclamation Temperature Model) for the lower American River at Watt Avenue were used as an indicator of changes in water temperatures that would potentially affect steelhead egg incubation. Predicted average water temperatures by month and water-year type are presented in Table 5C.5.2-224 and differences between pairs of model scenarios are presented in Table 5C.5.2-225. These results indicate that there would be very small (<2%) differences in mean monthly water temperature in the American River at Watt Avenue between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT during the primary steelhead egg incubation period (January through April) regardless of month and water-year type. Further, there would be no differences in mean monthly water temerpatures between the ESO model scenario and HOS and LOS scenarios during the primary steelhead egg incubation period (January through April) (Table 5C.5.2-226, Table 5C.5.2-227).

Table 5C.5.2-224. Mean Monthly Water Temperature (°F) in the American River at Watt Avenue under EBC and ESO Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	47	47	48	50	48	50
	AN	47	47	48	49	48	49
	BN	46	46	47	49	47	49
	D	46	46	47	49	47	49
	C	46	46	48	49	48	50
	All	46	46	48	49	48	49
Feb	W	48	48	50	52	50	52
	AN	48	48	50	52	50	52
	BN	48	48	49	51	49	51
	D	49	49	51	52	51	52
	C	51	51	53	54	53	54
	All	49	49	50	52	50	52
Mar	W	53	53	54	56	54	56
	AN	53	53	54	56	54	56
	BN	54	54	55	56	55	56
	D	54	54	56	57	56	57
	C	56	56	57	58	57	58
	All	54	54	55	56	55	56
Apr	W	56	56	58	59	58	59
	AN	58	58	59	61	59	61
	BN	58	58	60	61	60	61
	D	60	60	61	63	61	63
	C	61	61	62	64	62	64
	All	58	58	60	61	60	61
May	W	61	61	63	65	63	65
	AN	62	62	65	67	65	67
	BN	62	63	65	67	64	66
	D	65	65	67	68	67	67
	C	66	66	68	69	67	69
	All	63	63	65	67	65	67
Jun	W	65	65	67	68	67	68
	AN	67	67	69	70	68	69
	BN	67	67	69	70	69	69
	D	69	69	70	71	69	71
	C	69	70	72	73	72	73
	All	67	67	69	70	69	69
Jul	W	68	68	70	70	69	70
	AN	67	68	68	68	68	68
	BN	67	68	68	69	68	69
	D	68	69	70	71	70	72
	C	72	73	74	76	74	76
	All	68	69	70	71	70	71

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Aug	W	68	69	70	72	71	72
	AN	69	69	70	72	70	72
	BN	69	70	71	72	71	73
	D	69	70	71	73	72	74
	C	71	72	75	77	75	77
	All	69	70	71	73	72	73
Sep	W	66	66	67	69	67	69
	AN	66	66	67	70	68	71
	BN	67	68	68	70	69	71
	D	67	68	69	72	69	72
	C	69	69	71	73	71	74
	All	67	67	68	71	69	71
Oct	W	59	60	63	67	63	67
	AN	60	60	63	67	63	67
	BN	59	60	63	68	63	68
	D	60	60	64	67	63	67
	C	61	62	64	68	64	68
	All	60	60	63	67	63	67
Nov	W	56	57	58	60	58	60
	AN	56	57	58	60	58	60
	BN	56	56	58	60	58	59
	D	56	56	58	59	58	59
	C	57	57	59	60	59	60
	All	56	57	58	60	58	60
Dec	W	50	49	51	52	51	52
	AN	50	50	51	52	51	52
	BN	49	49	50	51	50	51
	D	49	49	50	52	50	52
	C	49	48	50	51	50	51
	All	49	49	50	52	50	52

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of scenarios.

Table 5C.5.2-225. Differences[a] between EBC and ESO Scenarios in Mean Monthly Water Temperature (°F) in the American River at Watt Avenue

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	1 (3%)	3 (6.7%)	1 (3.1%)	3 (6.8%)	0 (0%)	0.04 (0.1%)
	AN	1 (2.7%)	3 (5.8%)	1 (2.9%)	3 (5.9%)	0.03 (0.1%)	0 (0%)
	BN	1 (3%)	3 (6.4%)	1 (3.2%)	3 (6.6%)	0 (0%)	0 (0%)
	D	1 (2.6%)	3 (5.7%)	1 (2.9%)	3 (6%)	0 (0%)	-0.1 (-0.2%)
	C	1 (2.9%)	3 (6.6%)	1 (3.1%)	3 (6.8%)	0.03 (0.1%)	0.1 (0.3%)
	All	1 (2.9%)	3 (6.3%)	1 (3%)	3 (6.5%)	0 (0%)	0 (0%)
Feb	W	2 (3.4%)	3 (7.1%)	2 (3.3%)	3 (7%)	0 (0%)	0 (0%)
	AN	2 (3.7%)	4 (7.7%)	2 (3.2%)	3 (7.2%)	-0.03 (-0.1%)	0 (0%)
	BN	2 (3.4%)	3 (6.7%)	2 (3.3%)	3 (6.6%)	-0.05 (-0.1%)	0.05 (0.1%)
	D	2 (3.2%)	3 (6.5%)	1 (2.9%)	3 (6.2%)	-0.03 (-0.1%)	-0.03 (-0.1%)
	C	2 (3%)	3 (6.6%)	2 (3.3%)	4 (6.9%)	0.1 (0.3%)	0.1 (0.2%)
	All	2 (3.3%)	3 (6.9%)	2 (3.2%)	3 (6.8%)	0 (0%)	0 (0%)
Mar	W	1 (2.6%)	3 (5.7%)	1 (2.5%)	3 (5.6%)	0 (0%)	0 (0%)
	AN	1 (2.6%)	3 (5.4%)	1 (2.3%)	3 (5.1%)	0.04 (0.1%)	0 (0%)
	BN	1 (2.2%)	3 (4.8%)	1 (2.2%)	3 (4.8%)	0 (0%)	0 (0%)
	D	1 (2.6%)	3 (5.8%)	1 (2.5%)	3 (5.6%)	-0.1 (-0.2%)	-0.05 (-0.1%)
	C	1 (2.1%)	3 (4.9%)	1 (2.2%)	3 (5%)	-0.1 (-0.2%)	0 (0%)
	All	1 (2.5%)	3 (5.4%)	1 (2.4%)	3 (5.3%)	-0.04 (-0.1%)	0 (0%)
Apr	W	1 (2.2%)	3 (5.1%)	1 (2.1%)	3 (5%)	0 (0%)	0 (0%)
	AN	1 (2.3%)	3 (5.4%)	1 (2.2%)	3 (5.3%)	0 (0%)	0 (0%)
	BN	1 (2.1%)	3 (5.1%)	1 (1.9%)	3 (4.9%)	-0.1 (-0.1%)	-0.04 (-0.1%)
	D	1 (1.5%)	3 (4.2%)	1 (2.1%)	3 (4.9%)	0 (0%)	-0.04 (-0.1%)
	C	1 (1.7%)	3 (5.2%)	1 (1.8%)	3 (5.3%)	-0.4 (-0.6%)	0.3 (0.5%)
	All	1 (1.9%)	3 (4.9%)	1 (2.1%)	3 (5.1%)	-0.1 (-0.1%)	0.03 (0.1%)
May	W	2 (3.5%)	4 (6.9%)	2 (3.3%)	4 (6.7%)	0 (0%)	-0.1 (-0.1%)
	AN	2 (4%)	5 (7.2%)	2 (3.7%)	4 (7%)	-0.2 (-0.2%)	-0.3 (-0.5%)
	BN	2 (3.2%)	4 (6.1%)	2 (3%)	4 (5.9%)	-0.2 (-0.4%)	-0.3 (-0.5%)
	D	2 (2.9%)	2 (3.6%)	2 (2.8%)	2 (3.5%)	0.1 (0.1%)	-1 (-0.9%)
	C	2 (2.3%)	3 (5.1%)	1 (2.1%)	3 (5%)	-0.2 (-0.2%)	0.1 (0.1%)
	All	2 (3.2%)	4 (5.8%)	2 (3%)	4 (5.6%)	-0.1 (-0.1%)	-0.3 (-0.4%)
Jun	W	2 (2.9%)	3 (4.2%)	2 (2.6%)	3 (3.9%)	-0.2 (-0.4%)	-1 (-1.1%)
	AN	1 (2.1%)	2 (3.1%)	1 (1.8%)	2 (2.9%)	-1 (-1.1%)	-1 (-1.2%)
	BN	2 (2.6%)	2 (3.2%)	1 (1.9%)	2 (2.5%)	-0.5 (-0.7%)	-1 (-1.3%)
	D	1 (0.8%)	2 (2.6%)	-0.04 (-0.1%)	1 (1.8%)	-1 (-1.3%)	-0.5 (-0.6%)
	C	2 (3.5%)	4 (5.5%)	2 (2.6%)	3 (4.6%)	0 (0%)	-0.1 (-0.2%)
	All	2 (2.3%)	3 (3.7%)	1 (1.8%)	2 (3.2%)	-0.5 (-0.7%)	-1 (-0.9%)
Jul	W	1 (1.9%)	2 (3.1%)	1 (0.9%)	2 (2.2%)	-1 (-0.9%)	0.1 (0.1%)
	AN	1 (1.3%)	1 (1.6%)	0.3 (0.5%)	1 (0.8%)	0 (0%)	0.2 (0.3%)
	BN	1 (1.5%)	2 (3%)	1 (1%)	2 (2.5%)	-0.1 (-0.2%)	0.3 (0.4%)
	D	2 (2.9%)	4 (6%)	1 (1.9%)	3 (4.9%)	0.3 (0.4%)	1 (1.7%)
	C	2 (3.3%)	4 (5.6%)	1 (1.9%)	3 (4.1%)	0.2 (0.3%)	0.1 (0.2%)
	All	1 (2.2%)	3 (3.9%)	1 (1.2%)	2 (3%)	-0.1 (-0.2%)	0.4 (0.5%)

Month	Water-Year Type[b]	Scenarios[c] EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Aug	W	2.6 (3.9%)	4 (6%)	2 (2.8%)	3 (4.8%)	0.3 (0.5%)	-0.1 (-0.1%)
	AN	1.8 (2.6%)	3 (4.3%)	1.4 (2%)	3 (3.7%)	0.1 (0.1%)	0 (0%)
	BN	2 (2.9%)	4 (5.6%)	1 (2%)	3 (4.6%)	0.2 (0.3%)	1 (1.8%)
	D	3 (5.1%)	5 (7.6%)	3 (3.7%)	4 (6.2%)	1 (1.1%)	1 (0.8%)
	C	3 (4.8%)	6 (8.2%)	3 (4.1%)	5 (7.5%)	0.2 (0.3%)	0.4 (0.5%)
	All	3 (4%)	4 (6.4%)	2 (3%)	4 (5.3%)	0.4 (0.5%)	0.4 (0.5%)
Sep	W	1 (2.1%)	3 (5%)	1 (1.8%)	3 (4.7%)	0.5 (0.7%)	0.3 (0.5%)
	AN	1 (1.9%)	4 (6.1%)	1 (1.9%)	4 (6.2%)	0.5 (0.7%)	1 (0.9%)
	BN	2 (2.8%)	4 (5.3%)	1 (1.9%)	3 (4.4%)	1 (1%)	0.2 (0.3%)
	D	2 (2.8%)	4 (6.6%)	1 (2%)	4 (5.8%)	0.3 (0.4%)	-0.3 (-0.5%)
	C	2 (2.9%)	4 (6.4%)	2 (2.9%)	4 (6.3%)	0 (0%)	0.1 (0.1%)
	All	2 (2.5%)	4 (5.8%)	1 (2.1%)	4 (5.3%)	0.4 (0.6%)	0.2 (0.2%)
Oct	W	4 (6.6%)	8 (12.7%)	3 (5.1%)	7 (11.1%)	0.1 (0.1%)	-0.2 (-0.4%)
	AN	4 (6%)	8 (12.6%)	3 (5.1%)	7 (11.7%)	0 (0%)	0.1 (0.1%)
	BN	4 (6.1%)	8 (14%)	3 (5.3%)	8 (13.1%)	0.2 (0.4%)	0.1 (0.1%)
	D	4 (6%)	7 (11.6%)	3 (5.1%)	6 (10.6%)	-0.1 (-0.1%)	0.1 (0.2%)
	C	3 (4.9%)	6 (10.3%)	2 (3.7%)	6 (9.1%)	0 (0%)	0.2 (0.2%)
	All	4 (6.1%)	7 (12.3%)	3 (4.9%)	7 (11.1%)	0.04 (0.1%)	0 (0%)
Nov	W	2 (2.9%)	3 (6.1%)	1 (2.3%)	3 (5.4%)	-0.2 (-0.4%)	-0.2 (-0.3%)
	AN	2 (3.1%)	3 (6.2%)	1 (2.6%)	3 (5.6%)	-0.1 (-0.2%)	-0.1 (-0.2%)
	BN	2 (4%)	4 (7%)	2 (2.9%)	3 (5.9%)	-0.2 (-0.4%)	-0.1 (-0.2%)
	D	2 (3.3%)	3 (6.1%)	1 (2.6%)	3 (5.4%)	-0.1 (-0.1%)	-0.04 (-0.1%)
	C	2 (3.2%)	3 (5.8%)	2 (2.8%)	3 (5.4%)	0.05 (0.1%)	-0.1 (-0.1%)
	All	2 (3.2%)	3 (6.2%)	1 (2.6%)	3 (5.5%)	-0.1 (-0.3%)	-0.1 (-0.2%)
Dec	W	1 (1.8%)	2 (4.9%)	1 (2.4%)	3 (5.5%)	0 (0%)	-0.1 (-0.1%)
	AN	1 (1.9%)	3 (5.1%)	1 (2.3%)	3 (5.5%)	0.04 (0.1%)	0 (0%)
	BN	1 (2.3%)	3 (5.3%)	1 (2.6%)	3 (5.6%)	0 (0%)	0 (0%)
	D	1 (2.1%)	2 (4.9%)	1 (2.4%)	3 (5.2%)	-0.1 (-0.1%)	-0.1 (-0.1%)
	C	1 (2.2%)	2 (4.9%)	1 (2.5%)	3 (5.2%)	0.1 (0.3%)	0.1 (0.2%)
	All	1 (2%)	2 (5%)	1 (2.4%)	3 (5.4%)	0 (0%)	0 (0%)

[a] Positive values indicate higher temperature under ESO than under EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of scenarios.

Table 5C.5.2-226. Mean Monthly Water Temperature (°F) in the American River at Watt Avenue for ESO, HOS, and LOS Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	48	50	48	50	48	50
	AN	48	49	48	49	48	49
	BN	47	49	47	49	47	49
	D	47	49	47	49	47	49
	C	48	50	48	49	48	49
	All	48	49	48	49	48	49
Feb	W	50	52	50	52	50	52
	AN	50	52	50	52	50	52
	BN	49	51	49	51	49	51
	D	51	52	51	52	51	52
	C	53	54	53	54	53	54
	All	50	52	50	52	50	52
Mar	W	54	56	54	56	54	56
	AN	54	56	54	56	54	56
	BN	55	56	55	56	55	56
	D	56	57	56	57	56	57
	C	57	58	57	58	57	58
	All	55	56	55	56	55	56
Apr	W	58	59	58	59	58	59
	AN	59	61	59	61	59	61
	BN	60	61	60	61	60	61
	D	61	63	61	63	61	63
	C	62	64	62	64	62	64
	All	60	61	60	61	60	61
May	W	63	65	63	65	63	65
	AN	65	67	65	67	65	67
	BN	64	66	65	67	64	66
	D	67	67	67	68	67	68
	C	67	69	68	69	68	69
	All	65	67	65	67	65	67
Jun	W	67	68	67	68	67	67
	AN	68	69	69	70	68	69
	BN	69	69	69	70	68	68
	D	69	71	71	71	69	71
	C	72	73	72	73	72	72
	All	69	69	69	70	68	69
Jul	W	69	70	69	70	69	70
	AN	68	68	68	69	68	68
	BN	68	69	68	69	68	70
	D	70	72	70	71	70	72
	C	74	76	74	76	73	76
	All	70	71	70	71	70	71

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Aug	W	71	72	70	72	71	72
	AN	70	72	70	71	70	72
	BN	71	73	70	72	71	73
	D	72	74	71	73	72	74
	C	75	77	74	77	75	77
	All	72	73	71	73	72	73
Sep	W	67	69	67	69	68	70
	AN	68	71	67	70	68	71
	BN	69	71	69	70	69	70
	D	69	72	69	72	69	72
	C	71	74	71	73	71	73
	All	69	71	68	71	69	71
Oct	W	63	67	63	67	63	66
	AN	63	67	63	68	63	67
	BN	63	68	63	68	63	67
	D	63	67	64	66	63	67
	C	64	68	64	68	64	67
	All	63	67	63	67	63	67
Nov	W	58	60	58	60	58	60
	AN	58	60	58	60	58	60
	BN	58	59	58	60	58	60
	D	58	59	58	59	58	59
	C	59	60	59	60	59	60
	All	58	60	58	60	58	60
Dec	W	51	52	51	52	51	52
	AN	51	52	51	52	51	52
	BN	50	51	50	52	50	52
	D	50	52	50	52	50	52
	C	50	51	50	51	50	51
	All	50	52	50	52	50	52

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of scenarios.

1 **Table 5C.5.2-227. Differences[a] between ESO Scenarios and HOS and LOS Scenarios in Mean Monthly**
2 **Water Temperature (°F) in the American River at Watt Avenue**

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0.04 (0.1%)	0.04 (0.1%)	0.05 (0.1%)	0.1 (0.2%)
	BN	0 (0%)	0.03 (0.1%)	0 (0%)	0.1 (0.1%)
	D	0.04 (0.1%)	0.1 (0.1%)	-0.04 (-0.1%)	0 (0%)
	C	0.1 (0.1%)	-0.1 (-0.2%)	0.02 (0.1%)	-0.1 (-0.2%)
	All	0.02 (0.1%)	0 (0%)	0 (0%)	0 (0%)
Feb	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	-0.04 (-0.1%)	-0.1 (-0.3%)
	BN	0.03 (0.1%)	-0.04 (-0.1%)	0.04 (0.1%)	-0.05 (-0.1%)
	D	0.1 (0.1%)	0 (0%)	0.1 (0.1%)	0.1 (0.1%)
	C	0.1 (0.1%)	-0.2 (-0.4%)	-0.1 (-0.2%)	-0.3 (-0.5%)
	All	0.03 (0.1%)	-0.04 (-0.1%)	0 (0%)	-0.1 (-0.1%)
Mar	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	-0.04 (-0.1%)	0 (0%)	0.1 (0.1%)
	BN	0 (0%)	0.05 (0.1%)	0 (0%)	0 (0%)
	D	0.1 (0.1%)	0.03 (0.1%)	0.1 (0.2%)	-0.04 (-0.1%)
	C	0.1 (0.2%)	0 (0%)	0.1 (0.3%)	-0.04 (-0.1%)
	All	0 (0%)	0 (0%)	0.05 (0.1%)	0 (0%)
Apr	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0.1 (0.1%)	0 (0%)	0 (0%)	-0.04 (-0.1%)
	D	0 (0%)	0.1 (0.2%)	0.2 (0.4%)	0.1 (0.1%)
	C	0.4 (0.6%)	-0.3 (-0.4%)	0 (0%)	-0.2 (-0.3%)
	All	0.1 (0.1%)	0 (0%)	0.1 (0.1%)	0 (0%)
May	W	0 (0%)	0.1 (0.1%)	0 (0%)	0.03 (0.1%)
	AN	0.1 (0.1%)	0.2 (0.3%)	0 (0%)	0 (0%)
	BN	0.2 (0.4%)	0.4 (0.6%)	0 (0%)	-0.1 (-0.2%)
	D	0.04 (0.1%)	0.4 (0.5%)	0 (0%)	0.2 (0.4%)
	C	0.2 (0.3%)	-0.1 (-0.1%)	1 (0.9%)	0 (0%)
	All	0.1 (0.1%)	0.2 (0.3%)	0.1 (0.1%)	0.05 (0.1%)
Jun	W	0.2 (0.3%)	1 (0.8%)	0 (0%)	-0.1 (-0.2%)
	AN	1 (1.4%)	1 (1.7%)	0.1 (0.1%)	0 (0%)
	BN	1 (0.9%)	1 (0.8%)	-1 (-1.1%)	-1 (-1.5%)
	D	1 (2%)	1 (1%)	0 (0%)	0.1 (0.2%)
	C	-0.1 (-0.2%)	-1 (-0.8%)	0 (0%)	-1 (-1%)
	All	1 (0.9%)	1 (0.7%)	-0.1 (-0.1%)	-0.3 (-0.4%)
Jul	W	0.1 (0.2%)	-0.1 (-0.1%)	0.04 (0.1%)	-0.1 (-0.1%)
	AN	-0.2 (-0.3%)	0.1 (0.2%)	0 (0%)	0.05 (0.1%)
	BN	0.2 (0.3%)	0.1 (0.1%)	0.2 (0.3%)	1 (1.1%)
	D	-0.1 (-0.1%)	-1 (-1.2%)	-0.4 (-0.6%)	-0.2 (-0.3%)
	C	0.2 (0.3%)	0 (0%)	-1 (-1.1%)	1 (0.7%)
	All	0.1 (0.1%)	-0.2 (-0.2%)	-0.2 (-0.2%)	0.1 (0.2%)

Month	Water-Year Type[b]	Scenarios[c] ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	-0.2 (-0.3%)	-0.3 (-0.4%)	0 (0%)	0.1 (0.1%)
	AN	-0.4 (-0.5%)	-0.4 (-0.6%)	-0.05 (-0.1%)	0 (0%)
	BN	-1 (-1.5%)	-1 (-1.4%)	-0.2 (-0.2%)	0.1 (0.1%)
	D	-1 (-1.2%)	-1 (-0.7%)	-0.1 (-0.1%)	0.04 (0.1%)
	C	-1 (-0.7%)	-0.1 (-0.2%)	0 (0%)	-0.3 (-0.4%)
	All	-1 (-0.8%)	-0.4 (-0.6%)	-0.1 (-0.1%)	0 (0%)
Sep	W	-0.2 (-0.4%)	-0.3 (-0.4%)	1 (1%)	1 (1.4%)
	AN	-0.3 (-0.4%)	-1 (-1%)	1 (0.8%)	0.4 (0.6%)
	BN	0.1 (0.2%)	-0.3 (-0.4%)	0.1 (0.1%)	-0.1 (-0.1%)
	D	-0.2 (-0.3%)	0.1 (0.1%)	0.04 (0.1%)	0.2 (0.3%)
	C	0.1 (0.1%)	-0.1 (-0.1%)	0.2 (0.3%)	-0.1 (-0.2%)
	All	-0.1 (-0.2%)	-0.2 (-0.3%)	0.3 (0.5%)	0.4 (0.5%)
Oct	W	0 (0%)	0 (0%)	-0.1 (-0.2%)	-0.4 (-0.6%)
	AN	0.04 (0.1%)	0.2 (0.3%)	-0.3 (-0.5%)	-0.3 (-0.5%)
	BN	-0.1 (-0.2%)	0.04 (0.1%)	-0.3 (-0.4%)	-1 (-1.5%)
	D	0.2 (0.3%)	-0.3 (-0.4%)	-0.2 (-0.4%)	-0.2 (-0.3%)
	C	-0.05 (-0.1%)	-0.3 (-0.4%)	-0.1 (-0.1%)	-0.4 (-0.6%)
	All	0 (0%)	-0.1 (-0.1%)	-0.2 (-0.3%)	-0.5 (-0.7%)
Nov	W	0.1 (0.1%)	0 (0%)	0.03 (0.1%)	0.1 (0.2%)
	AN	0.2 (0.3%)	-0.1 (-0.1%)	-0.1 (-0.1%)	0 (0%)
	BN	0.2 (0.3%)	0.2 (0.3%)	0 (0%)	0.2 (0.3%)
	D	0 (0%)	0.1 (0.2%)	-0.04 (-0.1%)	-0.1 (-0.2%)
	C	0.2 (0.3%)	0.2 (0.3%)	0.1 (0.2%)	0.1 (0.2%)
	All	0.1 (0.2%)	0.1 (0.1%)	0 (0%)	0.1 (0.1%)
Dec	W	0.1 (0.1%)	0.1 (0.2%)	0.1 (0.1%)	0.2 (0.4%)
	AN	0.1 (0.1%)	-0.04 (-0.1%)	0 (0%)	0.1 (0.2%)
	BN	0.04 (0.1%)	0.1 (0.2%)	0.1 (0.2%)	0.2 (0.4%)
	D	0 (0%)	0.2 (0.4%)	-0.1 (-0.2%)	0.1 (0.2%)
	C	0.2 (0.4%)	0.1 (0.2%)	0.04 (0.1%)	0.1 (0.2%)
	All	0.1 (0.1%)	0.1 (0.2%)	0 (0%)	0.2 (0.3%)

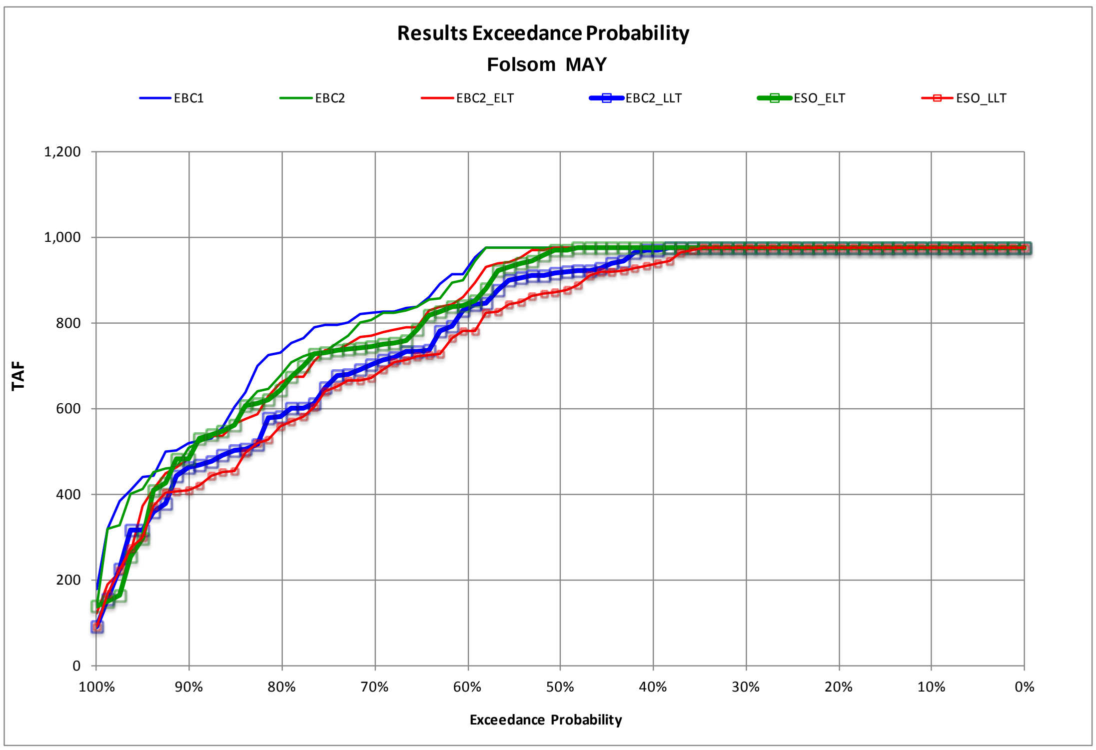
[a] Positive values indicate higher temperature under HOS or LOS than under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of scenarios.

Reservoir storage in May and September provides an indicator of coldwater pool availability. Results of CALSIM modeling of Folsom Reservoir storage in May and September are shown in Table 5C.5.2-228 with the corresponding frequency of exceedance analysis for May storage shown in Figure 5C.5.2-163and for September in Figure 5C.5.2-164. Differences between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT are reported in Table 5C.5.2-229. These results indicate that Folsom Reservoir storage and, therefore, coldwater pool volume would generally be similar between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. Two exceptions are in the LLT in above normal and critical water years. Despite these reductions under the ESO, water temperatures would generally not differ between EBC2 and ESO scenarios (Table 5C.5.2-224, Table 5C.5.2-225). May and September Folsom Reservoir storage under HOS and LOS scenarios would generally be similar to or greater than storage under ESO (Table 5C.5.2-230, Table 5C.5.2-231).

Table 5C.5.2-228. May and September Water Storage (Thousand Acre-Feet) in Folsom Reservoir under EBC and ESO Scenarios

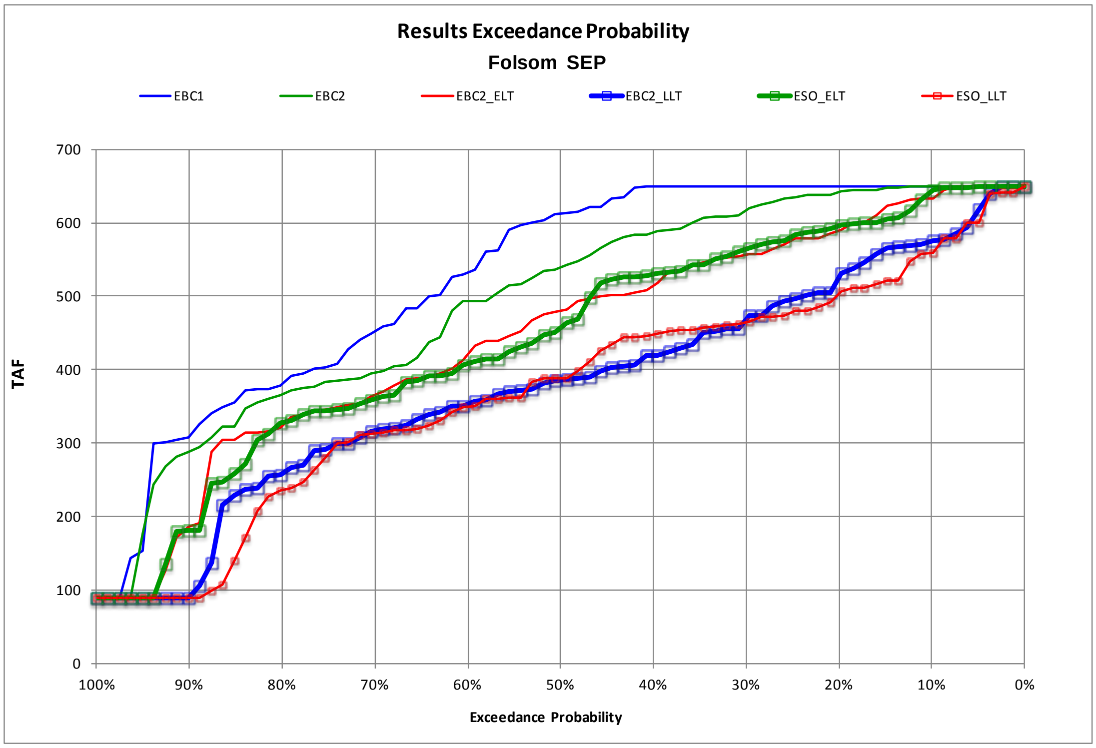
Water-Year Type	Scenario[a]					
	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
May						
Wet	966	964	957	943	957	938
Above Normal	968	966	955	930	947	913
Below Normal	934	928	920	891	907	864
Dry	806	777	749	691	744	662
Critical	448	430	396	360	386	346
All	850	839	823	791	817	774
September						
Wet	636	600	558	485	568	485
Above Normal	623	558	504	430	495	405
Below Normal	589	558	500	423	481	417
Dry	441	418	375	306	358	302
Critical	240	228	185	159	191	143
All	525	492	446	379	441	485

[a] See Table 5C.0-1 for definitions of scenarios.



Note: TAF = thousand acre-feet.

Figure 5C.5.2-163. Probability of Exceedance Plot for EBC and ESO Scenarios of Folsom Reservoir Water Storage Volume, May



Note: TAF = thousand acre-feet.

Figure 5C.5.2-164. Probability of Exceedance Plot for EBC and ESO Scenarios of Folsom Reservoir Water Storage Volume, September

Table 5C.5.2-229. Differences[a] between EBC and ESO Scenarios in May and September Water Storage (Thousand Acre-Feet) in Folsom Reservoir

Water-Year Type	Scenarios[b]	
	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
May		
Wet	0 (0%)	-5 (-0.6%)
Above Normal	-7 (-0.7%)	-16 (-1.7%)
Below Normal	-13 (-1.4%)	-26 (-3%)
Dry	-5 (-0.6%)	-29 (-4.1%)
Critical	-10 (-2.6%)	-14 (-3.8%)
All	-6 (-0.7%)	-17 (-2.1%)
September		
Wet	10 (1.9%)	0 (0%)
Above Normal	-9 (-1.9%)	-25 (-5.9%)
Below Normal	-19 (-3.7%)	-6 (-1.4%)
Dry	-17 (-4.6%)	-4 (-1.3%)
Critical	6 (3.1%)	-16 (-10.2%)
All	-4 (-0.9%)	-8 (-2.1%)

[a] Negative values indicate less water storage under ESO than under EBC.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-230. May and September Water Storage (Thousand Acre-Feet) in Folsom Reservoir for ESO, HOS, and LOS Scenarios

Water-Year Type	Scenario[b]					
	ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
May						
Wet	957	938	957	942	957	939
Above Normal	947	913	951	917	947	913
Below Normal	907	864	920	892	908	864
Dry	744	662	745	686	750	672
Critical	386	346	416	370	401	364
All	817	774	824	790	820	780
September						
Wet	568	485	557	468	609	541
Above Normal	495	405	498	437	520	424
Below Normal	481	417	504	437	464	401
Dry	358	302	382	320	349	311
Critical	191	143	232	148	179	163
All	441	371	453	379	451	394

[a] See Table 5C.0-1 for definitions of scenarios.

Table 5C.5.2-231. Differences[a] between ESO Scenarios and HOS and LOS Scenarios in May and September Water Storage (Thousand Acre-Feet) in Folsom Reservoir

Water-Year Type	Scenarios[b]			
	ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
May				
Wet	0 (0%)	4 (0.5%)	0 (0%)	1 (0.2%)
Above Normal	4 (0.4%)	3 (0.4%)	0 (0%)	0 (0%)
Below Normal	13 (1.4%)	28 (3.2%)	1 (0.2%)	0 (0%)
Dry	1 (0.2%)	24 (3.6%)	6 (0.8%)	9 (1.4%)
Critical	31 (8%)	24 (6.9%)	15 (3.9%)	19 (5.4%)
All	8 (0.9%)	15 (2%)	4 (0.4%)	5 (0.7%)
September				
Wet	-11 (-2%)	-16 (-3.3%)	41 (7.3%)	56 (11.6%)
Above Normal	3 (0.5%)	32 (7.9%)	25 (5%)	19 (4.8%)
Below Normal	23 (4.7%)	21 (4.9%)	-17 (-3.6%)	-15 (-3.7%)
Dry	24 (6.8%)	18 (5.9%)	-9 (-2.6%)	9 (2.9%)
Critical	41 (21.5%)	5 (3.6%)	-12 (-6.2%)	20 (14%)
All	12 (2.7%)	8 (2.1%)	10 (2.3%)	23 (6.2%)

[a] Positive values indicate greater water storage under HOS or LOS than under ESO.
[b] See Table 5C.0-1 for definitions of scenarios.

The exceedances of water temperatures above a 56°F threshold at the Watt Avenue bridge were evaluated for the steelhead spawning and egg incubation period (Section 5C.4, Table 5C.4-3). As discussed above, steelhead spawning and egg incubation generally occurs during January through April, although results are presented for November through April here to include the entire period requested by NMFS, which covers both steelhead and fall-run Chinook salmon spawning and egg incubation.

Table 5C.5.2-232 reports the percent of months during the 82-year modeling period for each month during November through April at the Watt Avenue bridge that exceeded the 56°F threshold by 1°F to 5°F in 1°F increments for each scenario. Table 5C.5.2-233 presents differences between model scenarios in these percent values. During the January through April steelhead spawning and egg incubation period, there would be negligible (<5% on an absolute scale) differences in the percent of months with exceedances between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. During January and February, there would be no differences in the percent of months with exceedances between EBC2 scenarios and HOS and LOS scenarios. During March and April, there would be no or small reductions (up to 10% fewer months on an absolute scale) in the percent of months with exceedances under HOS and LOS scenarios relative to EBC2 scenarios. These results indicate that ESO would have no temperature-related effects on steelhead spawning and egg incubation in the American River, whereas HOS and LOS scenarios would have small temperature-related benefits to steelhead spawning and egg incubation in the American River.

Table 5C.5.2-232. Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the American River at Watt Avenue Exceed the 56°F Threshold, November through April

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
EBC1					
November	46	27	14	2	1
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	12	7	2	1	0
April	70	62	46	32	27
EBC2					
November	51	33	20	6	0
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	11	7	2	1	0
April	69	60	43	32	27
EBC2_ELT					
November	83	60	43	31	19
December	1	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	19	14	10	2	2
April	88	74	64	49	32

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
ESO_ELT					
November	78	62	42	28	15
December	1	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	19	12	7	2	2
April	88	74	63	49	32
EBC2_LLT					
November	93	85	74	57	41
December	1	1	0	0	0
January	0	0	0	0	0
February	4	1	0	0	0
March	49	32	16	12	5
April	96	93	80	72	57
ESO_LLT					
November	93	81	72	57	36
December	2	1	0	0	0
January	0	0	0	0	0
February	4	1	0	0	0
March	46	32	16	12	6
April	95	93	80	70	59
HOS_ELT					
November	73	53	37	20	11
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	15	12	6	2	1
April	81	68	56	42	31
HOS_LLT					
November	89	78	63	48	33
December	1	1	0	0	0
January	0	0	0	0	0
February	1	1	0	0	0
March	40	25	14	11	4
April	96	86	73	62	52
LOS_ELT					
November	72	51	36	21	12
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	15	11	9	4	1
April	81	69	56	42	30

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
LOS_LLT					
November	90	75	68	46	32
December	2	1	0	0	0
January	0	0	0	0	0
February	1	0	0	0	0
March	40	22	15	10	5
April	95	86	73	63	52
Key:					
	0%				
	1–25%				
	26–50%				
	51–75%				
	76–100%				

Table 5C.5.2-233. Differences between Model Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the American River at Watt Avenue Exceed the 56°F Threshold, November through April

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
EBC1 vs. ESO_ELT					
November	32 (70%)	35 (127%)	28 (209%)	26 (1050%)	14 (1100%)
December	1 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	6 (50%)	5 (67%)	5 (200%)	1 (100%)	2 (NA)
April	17 (25%)	12 (20%)	17 (38%)	17 (54%)	5 (18%)
EBC1 vs. ESO_LLT					
November	47 (103%)	54 (200%)	58 (427%)	54 (2200%)	35 (2800%)
December	2 (NA)	1 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	4 (NA)	1 (NA)	0 (NA)	0 (NA)	0 (NA)
March	33 (270%)	25 (333%)	14 (550%)	11 (900%)	6 (NA)
April	25 (35%)	31 (50%)	35 (76%)	38 (119%)	32 (118%)
EBC2 vs. ESO_ELT					
November	27 (54%)	28 (85%)	22 (113%)	22 (360%)	15 (NA)
December	1 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	7 (67%)	5 (67%)	5 (200%)	1 (100%)	2 (NA)
April	19 (27%)	14 (22%)	20 (46%)	17 (54%)	5 (18%)

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
EBC2 vs. ESO_LLT					
November	42 (83%)	48 (144%)	52 (263%)	51 (820%)	36 (NA)
December	2 (NA)	1 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	4 (NA)	1 (NA)	0 (NA)	0 (NA)	0 (NA)
March	35 (311%)	25 (333%)	14 (550%)	11 (900%)	6 (NA)
April	26 (38%)	32 (53%)	37 (86%)	38 (119%)	32 (118%)
EBC2_ELT vs. ESO_ELT					
November	-5 (-6%)	1 (2%)	-1 (-3%)	-2 (-8%)	-4 (-20%)
December	0 (0%)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	0 (0%)	-1 (-9%)	-2 (-25%)	0 (0%)	0 (0%)
April	0 (0%)	0 (0%)	-1 (-2%)	0 (0%)	0 (0%)
EBC2_LLT vs. ESO_LLT					
November	0 (0%)	-4 (-4%)	-2 (-3%)	0 (0%)	-5 (-12%)
December	1 (100%)	0 (0%)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (0%)	0 (0%)	0 (NA)	0 (NA)	0 (NA)
March	-4 (-8%)	0 (0%)	0 (0%)	0 (0%)	1 (25%)
April	-1 (-1%)	0 (0%)	0 (0%)	-1 (-2%)	2 (4%)
EBC2_ELT vs. HOS_ELT					
November	-10 (-12%)	-7 (-12%)	-6 (-14%)	-11 (-36%)	-7 (-40%)
December	-1 (-100%)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	-4 (-20%)	-1 (-9%)	-4 (-38%)	0 (0%)	-1 (-50%)
April	-6 (-7%)	-6 (-8%)	-9 (-13%)	-7 (-15%)	-1 (-4%)
EBC2_LLT vs. HOS_LLT					
November	-4 (-4%)	-7 (-9%)	-11 (-15%)	-9 (-15%)	-7 (-18%)
December	0 (0%)	0 (0%)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	-2 (-67%)	0 (0%)	0 (NA)	0 (NA)	0 (NA)
March	-10 (-20%)	-7 (-23%)	-2 (-15%)	-1 (-10%)	-1 (-25%)
April	0 (0%)	-6 (-7%)	-7 (-9%)	-10 (-14%)	-5 (-9%)
EBC2_ELT vs. LOS_ELT					
November	-11 (-13%)	-10 (-16%)	-7 (-17%)	-10 (-32%)	-6 (-33%)
December	-1 (-100%)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	-4 (-20%)	-2 (-18%)	-1 (-13%)	1 (50%)	-1 (-50%)
April	-6 (-7%)	-5 (-7%)	-9 (-13%)	-7 (-15%)	-2 (-8%)

Month	Degrees Above Threshold >1.0	>2.0	>3.0	>4.0	>5.0
EBC2_LLT vs. LOS_LLT					
November	-2 (-3%)	-10 (-12%)	-6 (-8%)	-11 (-20%)	-9 (-21%)
December	1 (100%)	0 (0%)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	-2 (-67%)	-1 (-100%)	0 (NA)	0 (NA)	0 (NA)
March	-10 (-20%)	-10 (-31%)	-1 (-8%)	-2 (-20%)	0 (0%)
April	-1 (-1%)	-6 (-7%)	-7 (-9%)	-9 (-12%)	-5 (-9%)
NA = Could not calculate because dividing by 0.					

Degree-months for months that exceed the 56°F threshold were summed for all 82 years and are presented in Table 5C.5.2-234; differences between EBC2 and ESO scenarios are presented in Table 5C.5.2-235. Only January through April was considered for the analysis of steelhead spawning and egg incubation. These results indicate that there would be negligible differences in exceedances between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT throughout the steelhead spawning and egg incubation period. Table 5C.5.2-236 presents differences between EBC2 scenarios and HOS and LOS scenarios. As for ESO, there would be negligible differences in exceedances between EBC2 scenarios and HOS and LOS scenarios throughout the January through April steelhead spawning and egg incubation period.

Combined, these analyses of NMFS threshold exceedances indicate that there would be no effect of the ESO and small beneficial effects of HOS and LOS on temperature-related steelhead spawning and egg incubation conditions in the American River.

Table 5C.5.2-234. Total Degree-Months (°F-Months) by Month and Water-Year Type for Water Temperature Exceedances above 56°F in the American River at Watt Avenue, November through April

Month	Water-Year Type	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Nov	W	25	30	64	107	59	103	61	102	59	103
	AN	11	13	28	47	27	46	27	43	25	44
	BN	8	14	34	51	30	50	32	51	30	51
	D	13	16	39	64	38	62	36	63	37	59
	C	16	16	34	54	35	52	36	54	35	54
	All	73	89	199	323	189	313	191	313	187	311
Dec	W	0	0	0	0	0	1	0	1	0	1
	AN	0	0	0	0	0	0	0	0	0	0
	BN	0	0	1	2	1	2	1	2	1	2
	D	0	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0	0
	All	0	0	1	2	1	3	1	3	1	3
Jan	W	0	0	0	0	0	0	0	0	0	0
	AN	0	0	0	0	0	0	0	0	0	0
	BN	0	0	0	0	0	0	0	0	0	0
	D	0	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0	0
	All	0	0	0	0	0	0	0	0	0	0

Month	Water-Year Type	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Feb	W	0	0	0	0	0	0	0	0	0	0
	AN	0	0	0	0	0	0	0	0	0	0
	BN	0	0	0	0	0	0	0	0	0	0
	D	0	0	0	0	0	0	0	0	0	0
	C	0	0	0	4	0	4	0	3	0	3
	All	0	0	0	4	0	4	0	3	0	3
Mar	W	2	2	4	14	4	14	4	12	4	12
	AN	0	0	3	9	3	9	3	9	3	9
	BN	3	3	5	14	5	14	5	14	6	13
	D	4	4	9	29	7	28	9	29	10	28
	C	10	9	17	30	16	29	17	30	17	30
	All	19	18	38	96	35	94	38	94	39	92
Apr	W	28	26	50	86	50	86	47	85	47	85
	AN	22	22	36	56	36	56	36	55	36	55
	BN	36	37	52	77	51	76	52	76	52	75
	D	76	71	91	121	91	121	90	121	94	121
	C	59	58	75	94	73	99	76	94	72	95
	All	221	214	304	434	301	438	301	431	301	431

Table 5C.5.2-235. Differences between EBC and ESO Scenarios in Total Degree-Months (°F-Months) by Month and Water-Year Type for Water Temperature Exceedances above 56°F in the American River at Watt Avenue, November through April

Month	Water-Year Type	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Nov	W	34 (136%)	78 (312%)	29 (97%)	73 (243%)	-5 (-8%)	-4 (-4%)
	AN	16 (145%)	35 (318%)	14 (108%)	33 (254%)	-1 (-4%)	-1 (-2%)
	BN	22 (275%)	42 (525%)	16 (114%)	36 (257%)	-4 (-12%)	-1 (-2%)
	D	25 (192%)	49 (377%)	22 (138%)	46 (288%)	-1 (-3%)	-2 (-3%)
	C	19 (119%)	36 (225%)	19 (119%)	36 (225%)	1 (3%)	-2 (-4%)
	All	116 (159%)	240 (329%)	100 (112%)	224 (252%)	-10 (-5%)	-10 (-3%)
Dec	W	0 (NA)	1 (NA)	0 (NA)	1 (NA)	0 (NA)	1 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	1 (NA)	2 (NA)	1 (NA)	2 (NA)	0 (0%)	0 (0%)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	All	1 (NA)	3 (NA)	1 (NA)	3 (NA)	0 (0%)	1 (50%)
Jan	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)

Month	Water-Year Type	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Feb	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	0 (NA)	4 (NA)	0 (NA)	4 (NA)	0 (NA)	0 (0%)
	All	0 (NA)	4 (NA)	0 (NA)	4 (NA)	0 (NA)	0 (0%)
Mar	W	2 (100%)	12 (600%)	2 (100%)	12 (600%)	0 (0%)	0 (0%)
	AN	3 (NA)	9 (NA)	3 (NA)	9 (NA)	0 (0%)	0 (0%)
	BN	2 (67%)	11 (367%)	2 (67%)	11 (367%)	0 (0%)	0 (0%)
	D	3 (75%)	24 (600%)	3 (75%)	24 (600%)	-2 (-22%)	-1 (-3%)
	C	6 (60%)	19 (190%)	7 (78%)	20 (222%)	-1 (-6%)	-1 (-3%)
	All	16 (84%)	75 (395%)	17 (94%)	76 (422%)	-3 (-8%)	-2 (-2%)
Apr	W	22 (79%)	58 (207%)	24 (92%)	60 (231%)	0 (0%)	0 (0%)
	AN	14 (64%)	34 (155%)	14 (64%)	34 (155%)	0 (0%)	0 (0%)
	BN	15 (42%)	40 (111%)	14 (38%)	39 (105%)	-1 (-2%)	-1 (-1%)
	D	15 (20%)	45 (59%)	20 (28%)	50 (70%)	0 (0%)	0 (0%)
	C	14 (24%)	40 (68%)	15 (26%)	41 (71%)	-2 (-3%)	5 (5%)
	All	80 (36%)	217 (98%)	87 (41%)	224 (105%)	-3 (-1%)	4 (1%)
NA = Could not calculate because dividing by 0.							

Table 5C.5.2-236. Differences between EBC2 Scenarios and HOS and LOS Scenarios in Total Degree-Months (°F-Months) by Month and Water-Year Type for Water Temperature Exceedances above 56°F in the American River at Watt Avenue, November through April

Month	Water-Year Type	EBC2_ELT vs. HOS_ELT	EBC2_LLT vs. HOS_LLT	EBC2_ELT vs. LOS_ELT	EBC2_LLT vs. LOS_LLT
Nov	W	-3 (-5%)	-5 (-5%)	-5 (-8%)	-4 (-4%)
	AN	-1 (-4%)	-4 (-9%)	-3 (-11%)	-3 (-6%)
	BN	-2 (-6%)	0 (0%)	-4 (-12%)	0 (0%)
	D	-3 (-8%)	-1 (-2%)	-2 (-5%)	-5 (-8%)
	C	2 (6%)	0 (0%)	1 (3%)	0 (0%)
	All	-8 (-4%)	-10 (-3%)	-12 (-6%)	-12 (-4%)
Dec	W	0 (NA)	1 (NA)	0 (NA)	1 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	All	0 (0%)	1 (50%)	0 (0%)	1 (50%)
Jan	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)	0 (NA)	0 (NA)

Month	Water-Year Type	EBC2_ELT vs. HOS_ELT	EBC2_LLT vs. HOS_LLT	EBC2_ELT vs. LOS_ELT	EBC2_LLT vs. LOS_LLT
Feb	W	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	AN	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	BN	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	D	0 (NA)	0 (NA)	0 (NA)	0 (NA)
	C	0 (NA)	-1 (-25%)	0 (NA)	-1 (-25%)
	All	0 (NA)	-1 (-25%)	0 (NA)	-1 (-25%)
Mar	W	0 (0%)	-2 (-14%)	0 (0%)	-2 (-14%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	1 (20%)	-1 (-7%)
	D	0 (0%)	0 (0%)	1 (11%)	-1 (-3%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	-2 (-2%)	1 (3%)	-4 (-4%)
Apr	W	-3 (-6%)	-1 (-1%)	-3 (-6%)	-1 (-1%)
	AN	0 (0%)	-1 (-2%)	0 (0%)	-1 (-2%)
	BN	0 (0%)	-1 (-1%)	0 (0%)	-2 (-3%)
	D	-1 (-1%)	0 (0%)	3 (3%)	0 (0%)
	C	1 (1%)	0 (0%)	-3 (-4%)	1 (1%)
	All	-3 (-1%)	-3 (-1%)	-3 (-1%)	-3 (-1%)

Redd Dewatering

Management of instream flows in the American River is largely controlled by reservoir operations and releases. Ramping schedules have been established and are expected to be applied under all model scenarios. Instream flow maintenance and ramping are designed to minimize or avoid the risk of steelhead redd dewatering. No effect is expected on the risk of redd dewatering as a result of the ESO.

A smaller run of adult steelhead spawns in the lower American River in April. It is uncertain whether these fish represent a native life-history diversity group or reflect the influence of out-of-basin hatchery introductions. Instream flows during the late spring and early summer (April through July) are typically stable in drier years and exhibit a declining trend in wetter years (Table 5C.5.2-212 and Table 5C.5.2-214). Reduced flows after April predicted in all model scenarios would increase the risk of redd dewatering.

5C.5.2.5.1.2 Fry and Juvenile Rearing

Rearing Habitat

The freshwater life stages of steelhead occupy the American River throughout the year. Steelhead fry emerge from the gravel from March into June and grow quickly. The two primary potential effects of BDCP operations on habitat conditions for fry and juvenile steelhead rearing on the American River relate to changes in either instream flows or seasonal water temperatures.

Flow rates affect physical conditions (e.g., water depth and velocity) that can influence the value and quantity of fry and juvenile steelhead rearing habitat.

Flows in the lower American River below Nimbus Dam and at the confluence with the Sacramento River are summarized by month and water-year type throughout the year in Table 5C.5.2-212 and Table 5C.5.2-214, respectively, and monthly exceedance plots are presented in Figure 5C.5.2-139 through Figure 5C.5.2-150 and Figure 5C.5.2-151 through Figure 5C.5.2-162, respectively. Differences between pairs of model scenarios for below Nimbus Dam and at the confluence are presented in Table 5C.5.2-213 and Table 5C.5.2-215 respectively. Flows under ESO_ELT and ESO_LLT would generally be similar to flows under EBC2_ELT and EBC2_LLT, respectively, with some exceptions. Flows under ESO would generally be greater than under EBC2 during May and June and generally lower than flows under EBC2 during August, September and November. Overall, higher flows during May and June would be offset by lower flows during August, September, and November resulting in no overall effect of the ESO on year-round flows.

Flows under the LOS scenario in the American River below Nimbus Dam and at the confluence with the Sacramento River would generally be similar to flows under ESO with some exceptions (Table 5C.5.2-216 through Table 5C.5.2-219). September flows in wet and above normal water years would be 17% to 38% lower under LOS depending on month, water-year type, and location. This moderate reduction occurs only during two water-year types in one month of the year. Therefore, the reduction is not expected to have a biologically meaningful effect on fry and juvenile rearing habitat.

Flows under the HOS scenario would generally be similar to or greater than flows under ESO except in June and October (Table 5C.5.2-216 through Table 5C.5.2-219). Reductions in flows under the HOS during June and October would not result in reduced flows relative to EBC2 (Table 5C.5.2-212 and Table 5C.5.2-214). Higher flows under the HOS during August and September would mostly compensate for lower flows under the ESO, although some reductions relative to the EBC2 during the ELT would persist (Table 5C.5.2-212 through Table 5C.5.2-214). Overall, flows under HOS and LOS scenarios would generally not affect steelhead fry and juvenile rearing habtiat in the American River.

Year-round minimum flows of 1,750 cfs for critical habitat features in the American River have been established by NMFS (2009, in prep.) (Table 5C.5.2-9). Exceedance frequencies for each model scenario are presented in Table 5C.5.2-220 and differences between pairs of scenarios are presented in Table 5C.5.2-221. The exceedances of the 1,750 cfs flow thresholds under ESO_ELT would be similar to exceedances under EBC2_ELT in all water-year types except critical years, in which exceedance would be 36.4% higher under the ESO_ELT. The exceedances of the 1,750 cfs flow thresholds under ESO_LLT would be similar to exceedances under EBC2_LLT in wet, above normal, and below normal water years, and higher in dry and critical years by 7% to 10%. These results indicate the ESO would be beneficial to year-round critical habitat feature maintenance in dry and critical years and would have no effect in other water years. Exceedances of the 1,750 cfs threshold under HOS and LOS scenarios would generally be similar to exceedances under EBC2 scenarios (Table 5C.5.2-222, Table 5C.5.2-223).

Rearing steelhead fry and juveniles can be exposed to stranding and isolation from main channel flows when high flows are required for flood control or Delta outflow requirements results in short duration flow increases which are subsequently reduced after the requirement subsides. After high-flow events when rearing steelhead fry and juveniles issues are a concern, Reclamation coordinates flow reduction rates utilizing the CVPIA Section 3406(b)(2), *Integration Team and American River Operation Group* adaptive management processes to minimize the stranding and isolation concerns versus current hydrologic conditions and future hydrologic projections to Folsom coldwater management. Reclamation attempts to avoid flow fluctuations during nonflood-control events that raise flows above 4,000 cfs and then reduce flow back below 4,000 cfs as recommended by Snider et al. (2001). Flow fluctuations are sometimes difficult to avoid with competing standards to meet in the Delta and upstream so some stranding is expected to continue to occur at approximately the same level as under current conditions.

Water temperature modeling (Reclamation Temperature Model) predicts that mean monthly water temperatures in the American River at Watt Avenue would not differ in any month or water-year type between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT (Table 5C.5.2-224, Table 5C.5.2-225). Further, there would be no differences in mean monthly water temperatures in the American River at Watt Avenue between the ESO scenario and HOS and LOS scenarios throughout the year (Table 5C.5.2-226, Table 5C.5.2-227).

As requested by NMFS, the exceedances of water temperatures above a 65°F threshold at the Watt Avenue bridge were evaluated for the juvenile steelhead rearing period (Section 5C.4, Table 5C.4-3). Although juvenile steelhead rear in the American River year-round, NMFS requested that the period of May through October be evaluated here. Table 5C.5.2-237 reports the percent of months during the 82-year modeling period for each month during May through October at the Watt Avenue bridge that exceeded the 65°F threshold by 1°F to 5°F in 1°F increments for each scenario. Table 5C.5.2-238 presents differences between EBC and ESO scenarios in these percent values. Results are highly variable. In the ELT period, the percent of months exceeding the threshold under ESO scenarios would be lower than those under EBC2 scenarios during June and July, higher during August and September, and similar during May and October. In the LLT period, the percent of months exceeding the threshold under the ESO would be lower than those under EBC2 during May and June, higher during July, August, and September, and similar during October. The percent of months exceeding the threshold under HOS scenarios would be similar to or lower by up to 22% (absolute scale) than the percent under EBC2 depending on the month and degrees above the threshold. The percent of months exceeding the threshold under LOS scenarios would generally be lower than those under EBC2 scenarios during May, June, and October, higher September, and similar during July and August.

These results indicate that there would be both small beneficial and adverse temperature-related effects of the ESO and LOS on rearing conditions for juvenile steelhead in the American River but HOS would generally provide a small temperature-related benefit to juvenile steelhead rearing in the American River.

Table 5C.5.2-237. Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the American River at Watt Avenue Exceed the 65°F Threshold, May through October

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
EBC1					
May	20	15	11	6	5
June	64	53	41	31	21
July	100	99	63	36	17
August	100	98	81	48	31
September	85	53	32	16	7
October	5	2	0	0	0
EBC2					
May	22	15	10	6	5
June	68	57	46	36	25
July	100	98	79	46	30
August	100	100	88	67	44
September	91	56	38	20	7
October	6	2	0	0	0
EBC2_ELT					
May	47	37	23	12	9
June	91	78	63	53	43
July	100	100	95	65	47
August	100	100	99	93	77
September	94	81	58	38	26
October	23	14	6	1	0
ESO_ELT					
May	46	35	22	12	9
June	91	75	58	46	35
July	100	100	93	57	42
August	100	100	99	98	88
September	96	90	64	46	30
October	22	12	9	2	1
EBC2_LLT					
May	64	49	40	32	17
June	99	91	81	65	48
July	100	100	98	72	56
August	100	100	100	96	90
September	100	98	85	74	60
October	80	65	46	30	11

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
ESO_LLT					
May	60	48	35	27	15
June	99	88	73	52	38
July	100	100	99	78	59
August	100	100	100	99	98
September	100	99	90	79	60
October	80	65	42	27	12
HOS_ELT					
November	41	31	16	11	6
December	84	77	59	48	40
January	100	100	75	48	33
February	100	100	96	85	63
March	93	72	49	38	22
April	14	12	5	1	0
HOS_LLT					
November	59	47	32	25	14
December	98	90	67	52	43
January	100	100	91	69	52
February	100	100	99	93	88
March	99	95	79	64	51
April	77	43	36	21	9
LOS_ELT					
November	40	31	16	11	6
December	83	72	52	40	28
January	100	100	72	51	28
February	100	100	99	94	77
March	99	84	64	44	28
April	16	10	5	2	0
LOS_LLT					
November	54	47	32	21	11
December	98	86	56	40	27
January	100	100	89	70	53
February	100	100	100	98	94
March	100	100	95	80	62
April	69	46	30	14	7
Key:					
	0%				
	1–25%				
	26–50%				
	51–75%				
	76–100%				

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Table 5C.5.2-238. Differences between Model Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the American River at Watt Avenue Exceed the 65°F Threshold, May through October

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
EBC1 vs. ESO_ELT					
May	26 (131%)	20 (133%)	11 (100%)	6 (100%)	4 (75%)
June	27 (42%)	22 (42%)	17 (42%)	15 (48%)	14 (65%)
July	0 (0%)	1 (1%)	30 (47%)	21 (59%)	25 (143%)
August	0 (0%)	2 (3%)	17 (21%)	49 (103%)	57 (184%)
September	11 (13%)	37 (70%)	32 (100%)	30 (185%)	22 (300%)
October	17 (350%)	10 (400%)	9 (NA)	2 (NA)	1 (NA)
EBC1 vs. ESO_LLT					
May	41 (206%)	33 (225%)	23 (211%)	21 (340%)	10 (200%)
June	35 (54%)	35 (65%)	32 (79%)	21 (68%)	17 (82%)
July	0 (0%)	1 (1%)	36 (57%)	42 (117%)	42 (243%)
August	0 (0%)	2 (3%)	19 (23%)	51 (105%)	67 (216%)
September	15 (17%)	46 (86%)	58 (181%)	63 (392%)	53 (717%)
October	75 (1525%)	63 (2550%)	42 (NA)	27 (NA)	12 (NA)
EBC2 vs. ESO_ELT					
May	23 (106%)	20 (133%)	12 (125%)	6 (100%)	4 (75%)
June	23 (35%)	19 (33%)	12 (27%)	10 (28%)	10 (40%)
July	0 (0%)	2 (3%)	14 (17%)	11 (24%)	12 (42%)
August	0 (0%)	0 (0%)	11 (13%)	31 (46%)	43 (97%)
September	5 (5%)	35 (62%)	26 (68%)	26 (131%)	22 (300%)
October	16 (260%)	10 (400%)	9 (NA)	2 (NA)	1 (NA)
EBC2 vs. ESO_LLT					
May	38 (172%)	33 (225%)	25 (250%)	21 (340%)	10 (200%)
June	31 (45%)	31 (54%)	27 (59%)	16 (45%)	14 (55%)
July	0 (0%)	2 (3%)	20 (25%)	32 (70%)	30 (100%)
August	0 (0%)	0 (0%)	12 (14%)	32 (48%)	53 (119%)
September	9 (9%)	43 (78%)	52 (135%)	59 (300%)	53 (717%)
October	74 (1200%)	63 (2550%)	42 (NA)	27 (NA)	12 (NA)
EBC2_ELT vs. ESO_ELT					
May	-1 (-3%)	-2 (-7%)	-1 (-5%)	0 (0%)	0 (0%)
June	0 (0%)	-2 (-3%)	-5 (-8%)	-7 (-14%)	-9 (-20%)
July	0 (0%)	0 (0%)	-2 (-3%)	-9 (-13%)	-5 (-11%)
August	0 (0%)	0 (0%)	0 (0%)	5 (5%)	11 (15%)
September	2 (3%)	9 (11%)	6 (11%)	7 (19%)	4 (14%)
October	-1 (-5%)	-1 (-9%)	2 (40%)	1 (100%)	1 (NA)

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
EBC2_LLT vs. ESO_LLT					
May	-4 (-6%)	-1 (-3%)	-5 (-13%)	-5 (-15%)	-2 (-14%)
June	0 (0%)	-4 (-4%)	-9 (-11%)	-14 (-21%)	-10 (-21%)
July	0 (0%)	0 (0%)	1 (1%)	6 (9%)	4 (7%)
August	0 (0%)	0 (0%)	0 (0%)	2 (3%)	7 (8%)
September	0 (0%)	1 (1%)	5 (6%)	5 (7%)	0 (0%)
October	0 (0%)	0 (0%)	-4 (-8%)	-2 (-8%)	1 (11%)
EBC2_ELT vs. HOS_ELT					
May	-6 (-13%)	-6 (-17%)	-7 (-32%)	-1 (-10%)	-2 (-29%)
June	-7 (-8%)	-1 (-2%)	-4 (-6%)	-5 (-9%)	-4 (-9%)
July	0 (0%)	0 (0%)	-20 (-21%)	-17 (-26%)	-14 (-29%)
August	0 (0%)	0 (0%)	-2 (-3%)	-7 (-8%)	-14 (-18%)
September	-1 (-1%)	-10 (-12%)	-9 (-15%)	0 (0%)	-4 (-14%)
October	-10 (-42%)	-1 (-9%)	-1 (-20%)	0 (0%)	0 (NA)
EBC2_LLT vs. HOS_LLT					
May	-5 (-8%)	-2 (-5%)	-7 (-19%)	-7 (-23%)	-4 (-21%)
June	-1 (-1%)	-1 (-1%)	-15 (-18%)	-14 (-21%)	-5 (-10%)
July	0 (0%)	0 (0%)	-6 (-6%)	-2 (-3%)	-4 (-7%)
August	0 (0%)	0 (0%)	-1 (-1%)	-4 (-4%)	-2 (-3%)
September	-1 (-1%)	-2 (-3%)	-6 (-7%)	-10 (-13%)	-10 (-16%)
October	-4 (-5%)	-22 (-34%)	-10 (-22%)	-9 (-29%)	-2 (-22%)
EBC2_ELT vs. LOS_ELT					
May	-7 (-16%)	-6 (-17%)	-7 (-32%)	-1 (-10%)	-2 (-29%)
June	-9 (-9%)	-6 (-8%)	-11 (-18%)	-14 (-26%)	-15 (-34%)
July	0 (0%)	0 (0%)	-23 (-25%)	-15 (-23%)	-19 (-39%)
August	0 (0%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)
September	5 (5%)	2 (3%)	6 (11%)	6 (16%)	2 (10%)
October	-7 (-32%)	-4 (-27%)	-1 (-20%)	1 (100%)	0 (NA)
EBC2_LLT vs. LOS_LLT					
May	-10 (-15%)	-2 (-5%)	-7 (-19%)	-11 (-35%)	-6 (-36%)
June	-1 (-1%)	-5 (-5%)	-26 (-32%)	-26 (-40%)	-21 (-44%)
July	0 (0%)	0 (0%)	-9 (-9%)	-1 (-2%)	-2 (-4%)
August	0 (0%)	0 (0%)	0 (0%)	1 (1%)	4 (4%)
September	0 (0%)	2 (3%)	10 (12%)	6 (8%)	1 (2%)
October	-11 (-14%)	-20 (-30%)	-16 (-35%)	-16 (-54%)	-4 (-33%)
NA = Could not calculate because dividing by 0.					

Degree-months for May through October months that exceed the 65°F threshold were summed for all 82 years and are presented in Table 5C.5.2-239. Differences between EBC2 and ESO scenarios are presented in Table 5C.5.2-240. For all water years combined, exceedances above 65°F under ESO_ELT and ESO_LLT would generally be similar to or up to 13% lower than exceedances under EBC2_ELT and EBC2_LLT, respectively, except during August (5% greater) and September (11% greater) in ELT and during July in LLT (8% higher). This indicates that there would be both small beneficial and adverse effects of the ESO on rearing conditions for juvenile steelhead in the American River.

Differences between EBCs scenarios and HOS and LOS scenarios are presented in Table 5C.5.2-241. Results are highly variable. Exceedances under HOS would be similar (<5% difference) to those under EBC2 during May, June, July and September. Exceedances during August would be greater under HOS_ELT than under EBC2_ELT but not different between HOS_LLT and EBC2_LLT. Exceedances during October would be greater under HOS_ELT than under EBC2_LLT but lower under HOS_LLT than under EBC2_LLT. All differences between HOS and EBC2 scenarios are small and, therefore, not expected to be biologically meaningful to the steelhead population. Exceedances under LOS would be similar to those under EBC2 during August and October (ELT only). Exceedances under LOS would be lower than those under EBC2 during May, June, July (ELT only), and October (LLT only). Exceedances under LOS would higher than those under EBC2 during July (LLT only) and September.

Combined, these analyses of NMFS threshold exceedances indicate that there would be both small beneficial and small negative temperature-related effects of ESO and LOS and no or small beneficial temperature-related effects of HOS on juvenile steelhead rearing conditions in the American River.

Table 5C.5.2-239. Total Degree-Months (°F-Months) by Month and Water-Year Type for Water Temperature Exceedances above 65°F in the American River at Watt Avenue, May through September

Month	Water-Year Type	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
May	W	6	7	15	27	15	26	15	28	15	27
	AN	0	1	9	27	7	24	8	25	7	23
	BN	3	3	12	26	10	21	12	27	10	19
	D	22	22	43	56	44	46	43	51	43	49
	C	19	19	33	51	32	53	33	51	37	51
	All	50	52	112	187	108	170	110	181	111	170
June	W	17	19	55	85	48	64	51	80	47	62
	AN	24	26	44	56	36	45	48	58	38	45
	BN	29	34	57	67	50	57	59	64	39	42
	D	68	80	95	108	78	103	101	112	77	102
	C	50	60	82	100	83	97	80	91	81	89
	All	188	219	333	416	295	366	338	406	282	340
Jul	W	78	92	126	127	110	132	111	129	109	129
	AN	27	31	35	33	36	37	33	39	35	38
	BN	34	38	50	55	46	60	49	60	48	70
	D	62	72	90	113	97	133	93	117	88	128
	C	81	93	107	127	111	129	111	128	99	135
	All	282	326	408	455	400	491	397	473	378	500
Aug	W	79	98	141	187	148	185	140	176	145	185
	AN	41	45	58	74	60	73	56	68	60	72
	BN	56	67	83	93	85	110	69	96	82	111
	D	68	85	116	149	131	159	114	151	128	161
	C	79	83	117	143	119	148	111	145	118	143
	All	323	378	515	646	543	675	491	636	534	673

Month	Water-Year Type	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Sep	W	24	26	47	98	59	107	51	99	74	131
	AN	16	16	26	52	30	62	26	53	36	65
	BN	28	33	47	75	54	77	55	73	54	76
	D	42	50	72	128	77	123	70	122	76	125
	C	49	51	74	102	74	104	74	101	76	101
	All	159	176	266	455	294	473	277	448	315	498
Oct	W	1	2	6	55	7	49	6	48	6	44
	AN	0	0	5	26	5	27	7	29	5	26
	BN	0	0	2	39	3	39	3	38	3	29
	D	0	0	9	37	9	37	9	34	10	32
	C	5	5	14	35	14	36	14	32	14	33
	All	6	7	36	192	38	188	38	181	36	163

Table 5C.5.2-240. Differences between EBC and ESO Scenarios in Total Degree-Months (°F-Months) by Month and Water-Year Type for Water Temperature Exceedances above 65°F in the American River at Watt Avenue, May through September

Month	Water-Year Type	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
May	W	9 (150%)	20 (333%)	8 (114%)	19 (271%)	0 (0%)	-1 (-4%)
	AN	7 (NA)	24 (NA)	6 (600%)	23 (2300%)	-2 (-22%)	-3 (-11%)
	BN	7 (233%)	18 (600%)	7 (233%)	18 (600%)	-2 (-17%)	-5 (-19%)
	D	22 (100%)	24 (109%)	22 (100%)	24 (109%)	1 (2%)	-10 (-18%)
	C	13 (68%)	34 (179%)	13 (68%)	34 (179%)	-1 (-3%)	2 (4%)
	All	58 (116%)	120 (240%)	56 (108%)	118 (227%)	-4 (-4%)	-17 (-9%)
June	W	31 (182%)	47 (276%)	29 (153%)	45 (237%)	-7 (-13%)	-21 (-25%)
	AN	12 (50%)	21 (88%)	10 (38%)	19 (73%)	-8 (-18%)	-11 (-20%)
	BN	21 (72%)	28 (97%)	16 (47%)	23 (68%)	-7 (-12%)	-10 (-15%)
	D	10 (15%)	35 (51%)	-2 (-3%)	23 (29%)	-17 (-18%)	-5 (-5%)
	C	33 (66%)	47 (94%)	23 (38%)	37 (62%)	1 (1%)	-3 (-3%)
	All	107 (57%)	178 (95%)	76 (35%)	147 (67%)	-38 (-13%)	-50 (-12%)
Jul	W	32 (41%)	54 (69%)	18 (20%)	40 (43%)	-16 (-13%)	5 (4%)
	AN	9 (33%)	10 (37%)	5 (16%)	6 (19%)	1 (3%)	4 (12%)
	BN	12 (35%)	26 (76%)	8 (21%)	22 (58%)	-4 (-8%)	5 (9%)
	D	35 (56%)	71 (115%)	25 (35%)	61 (85%)	7 (8%)	20 (18%)
	C	30 (37%)	48 (59%)	18 (19%)	36 (39%)	4 (4%)	2 (2%)
	All	118 (42%)	209 (74%)	74 (23%)	165 (51%)	-8 (-2%)	36 (8%)
Aug	W	69 (87%)	106 (134%)	50 (51%)	87 (89%)	7 (5%)	-2 (-1%)
	AN	19 (46%)	32 (78%)	15 (33%)	28 (62%)	2 (3%)	-1 (-1%)
	BN	29 (52%)	54 (96%)	18 (27%)	43 (64%)	2 (2%)	17 (18%)
	D	63 (93%)	91 (134%)	46 (54%)	74 (87%)	15 (13%)	10 (7%)
	C	40 (51%)	69 (87%)	36 (43%)	65 (78%)	2 (2%)	5 (3%)
	All	220 (68%)	352 (109%)	165 (44%)	297 (79%)	28 (5%)	29 (4%)

Month	Water-Year Type	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Sep	W	35 (146%)	83 (346%)	33 (127%)	81 (312%)	12 (26%)	9 (9%)
	AN	14 (88%)	46 (288%)	14 (88%)	46 (288%)	4 (15%)	10 (19%)
	BN	26 (93%)	49 (175%)	21 (64%)	44 (133%)	7 (15%)	2 (3%)
	D	35 (83%)	81 (193%)	27 (54%)	73 (146%)	5 (7%)	-5 (-4%)
	C	25 (51%)	55 (112%)	23 (45%)	53 (104%)	0 (0%)	2 (2%)
	All	135 (85%)	314 (197%)	118 (67%)	297 (169%)	28 (11%)	18 (4%)
Oct	W	6 (600%)	48 (4800%)	5 (250%)	47 (2350%)	1 (17%)	-6 (-11%)
	AN	5 (NA)	27 (NA)	5 (NA)	27 (NA)	0 (0%)	1 (4%)
	BN	3 (NA)	39 (NA)	3 (NA)	39 (NA)	1 (50%)	0 (0%)
	D	9 (NA)	37 (NA)	9 (NA)	37 (NA)	0 (0%)	0 (0%)
	C	9 (180%)	31 (620%)	9 (180%)	31 (620%)	0 (0%)	1 (3%)
	All	32 (533%)	182 (3033%)	31 (443%)	181 (2586%)	2 (6%)	-4 (-2%)
NA = Could not calculate because dividing by 0.							

Table 5C.5.2-241. Differences between EBC2 Scenarios and HOS and LOS Scenarios in Total Degree-Months (°F-Months) by Month and Water-Year Type for Water Temperature Exceedances above 65°F in the American River at Watt Avenue, May through September

Month	Water-Year Type	EBC2_ELT vs. HOS_ELT	EBC2_LLT vs. HOS_LLT	EBC2_ELT vs. LOS_ELT	EBC2_LLT vs. LOS_LLT
May	W	0 (0%)	1 (4%)	0 (0%)	0 (0%)
	AN	-1 (-11%)	-2 (-7%)	-2 (-22%)	-4 (-15%)
	BN	0 (0%)	1 (4%)	-2 (-17%)	-7 (-27%)
	D	0 (0%)	-5 (-9%)	0 (0%)	-7 (-13%)
	C	0 (0%)	0 (0%)	4 (12%)	0 (0%)
	All	-2 (-2%)	-6 (-3%)	-1 (-1%)	-17 (-9%)
June	W	-4 (-7%)	-5 (-6%)	-8 (-15%)	-23 (-27%)
	AN	4 (9%)	2 (4%)	-6 (-14%)	-11 (-20%)
	BN	2 (4%)	-3 (-4%)	-18 (-32%)	-25 (-37%)
	D	6 (6%)	4 (4%)	-18 (-19%)	-6 (-6%)
	C	-2 (-2%)	-9 (-9%)	-1 (-1%)	-11 (-11%)
	All	5 (2%)	-10 (-2%)	-51 (-15%)	-76 (-18%)
Jul	W	-15 (-12%)	2 (2%)	-17 (-13%)	2 (2%)
	AN	-2 (-6%)	6 (18%)	0 (0%)	5 (15%)
	BN	-1 (-2%)	5 (9%)	-2 (-4%)	15 (27%)
	D	3 (3%)	4 (4%)	-2 (-2%)	15 (13%)
	C	4 (4%)	1 (1%)	-8 (-7%)	8 (6%)
	All	-11 (-3%)	18 (4%)	-30 (-7%)	45 (10%)
Aug	W	-1 (-1%)	-11 (-6%)	4 (3%)	-2 (-1%)
	AN	-2 (-3%)	-6 (-8%)	2 (3%)	-2 (-3%)
	BN	-14 (-17%)	3 (3%)	-1 (-1%)	18 (19%)
	D	-2 (-2%)	2 (1%)	12 (10%)	12 (8%)
	C	-6 (-5%)	2 (1%)	1 (1%)	0 (0%)
	All	-24 (-5%)	-10 (-2%)	19 (4%)	27 (4%)

Month	Water-Year Type	EBC2_ELT vs. HOS_ELT	EBC2_LLT vs. HOS_LLT	EBC2_ELT vs. LOS_ELT	EBC2_LLT vs. LOS_LLT
Sep	W	4 (9%)	1 (1%)	27 (57%)	33 (34%)
	AN	0 (0%)	1 (2%)	10 (38%)	13 (25%)
	BN	8 (17%)	-2 (-3%)	7 (15%)	1 (1%)
	D	-2 (-3%)	-6 (-5%)	4 (6%)	-3 (-2%)
	C	0 (0%)	-1 (-1%)	2 (3%)	-1 (-1%)
	All	11 (4%)	-7 (-2%)	49 (18%)	43 (9%)
Oct	W	0 (0%)	-7 (-13%)	0 (0%)	-11 (-20%)
	AN	2 (40%)	3 (12%)	0 (0%)	0 (0%)
	BN	1 (50%)	-1 (-3%)	1 (50%)	-10 (-26%)
	D	0 (0%)	-3 (-8%)	1 (11%)	-5 (-14%)
	C	0 (0%)	-3 (-9%)	0 (0%)	-2 (-6%)
	All	2 (6%)	-11 (-6%)	0 (0%)	-29 (-15%)

5C.5.2.5.1.3 Adult

Water Temperature

. Water temperature modeling (Reclamation Temperature Model) during the November through April adult steelhead upstream migration and holding period predicts that mean monthly water temperatures in the American River at Watt Avenue would not differ in any month or water-year type between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT (Table 5C.5.2-224, Table 5C.5.2-225). Further, there would be no differences in mean monthly water temperatures in the American River at Watt Avenue between the ESO scenario and HOS and LOS scenarios during these months (Table 5C.5.2-226, Table 5C.5.2-227). These results indicate that there would be no temperature-related effects of the ESO, HOS, or LOS on steelhead migration and holding in the American River. As a result, no further temperature-related biological analyses are necessary.

5C.5.2.5.2 Fall-Run/Late Fall–Run

5C.5.2.5.2.1 Eggs and Alevins

Upstream Spawning Habitat

The lower American River supports a population of naturally reproducing fall-run Chinook salmon that inhabit the river for spawning, egg incubation, juvenile rearing, and as habitat for upstream and downstream migration. Hatchery-produced fall-run Chinook salmon also return to the American River Nimbus Fish Hatchery.

Average flows by month and water-year type in the American River below Nimbus Dam and at the confluence with the Sacramento River during the fall-run Chinook salmon spawning and egg incubation period (October through January) are presented in Table 5C.5.2-212 and Table 5C.5.2-214, respectively. Differences between pairs of model scenarios for below Nimbus Dam and at the confluence are presented in Table 5C.5.2-213 and Table 5C.5.2-215, respectively. Monthly frequency of exceedance plots of flows below Nimbus Dam during October through January are presented in Figure 5C.5.2-148 through Figure 5C.5.2-150 and Figure 5C.5.2-139. Monthly frequency of exceedance plots for the confluence with the Sacramento River during October through January are presented in Figure 5C.5.2-160 through Figure 5C.5.2-162 and Figure 5C.5.2-151. Mean flows under ESO_ELT and ESO_LLT in both locations would generally be similar to flows under EBC2_ELT and EBC2_LLT during October, December, and January. Mean flows under ESO_ELT and ESO_LLT in both locations would generally be lower by up to 15% than flows under EBC2_ELT and EBC2_LLT during November. These flow reductions during November are considered small and would partially be offset by higher flows during other months. Flows under HOS and LOS scenarios during October through January would generally be similar to those under ESO, except in LOS_LLT during October, in which flows would be 3% to 13% lower than those under ESO_LLT. However, these reductions are not likely to represent biologically meaningful effects to fall-run Chinook salmon spawning and egg incubation habitat because they occur during only one month and are low magnitude. Overall, flow-related effects of ESO, HOS, and LOS scenarios would not result in a biologically meaningful effect on fall-run Chinook salmon spawning and egg incubation habitat.

Water Temperature

Fall-run Chinook salmon spawning and egg incubation occurs in the American River downstream of Nimbus Dam. Fall-run salmon spawn in the late fall (October through January), when seasonal air temperatures in the Sacramento area are declining and habitat conditions for fall-run salmon spawning are generally improving. The area of the river where suitable water temperatures occur for successful egg incubation depends on the temperature of water released to the river from Folsom and Nimbus dams, the rate of instream flow, and atmospheric conditions that result in river warming as the water travels downstream from the dam. When coldwater storage in Folsom Reservoir is reduced, the amount of cold water available for release is reduced and the temperature of the water at the point of release to the river is increased. Under these conditions, the length of river downstream of Nimbus Dam that maintains suitable water temperatures for fall-run Chinook salmon egg incubation and hatching is reduced and those eggs that were spawned in the downstream areas are exposed to increased water temperature and egg mortality.

Water temperature modeling (Reclamation Temperature Model) predicts that water temperatures in the American River at Watt Avenue would not differ in any month or water-year type between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT during the October through January spawning and egg incubation period (Table 5C.5.2-224, Table 5C.5.2-225). Further, there would be no differences in water temperatures during October through January at Watt Avenue between the ESO scenario and HOS and LOS scenarios (Table 5C.5.2-226, Table 5C.5.2-227).

The exceedances of water temperatures above a 56°F threshold at the Watt Avenue bridge were also evaluated for the fall-run spawning and egg incubation period during November through January (Section 5C.4, Table 5C.4-3). In general, these results indicate that there would be negligible differences in exceedances between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT throughout the fall-run Chinook salmon spawning and egg incubation period (Table 5C.5.2-232, Table 5C.5.2-233, Table 5C.5.2-234, Table 5C.5.2-235. Also, there would be small beneficial effects of HOS and LOS on fall-run Chinook salmon spawning and egg incubation relative to EBC2 scenarios Table 5C.5.2-236).

The Reclamation egg mortality model was used to estimate the effect of the ESO on fall-run egg survival in the American River. Egg mortality in the American River occurs primarily early in the season (October to mid-November), after the coldwater pool in Folsom Reservoir is depleted and before natural cooling reduces temperatures to levels more conducive to egg survival. The Folsom Reservoir storage is small for the size of the watershed in comparison with other Central Valley reservoirs, so that even when the reservoir fills, it is difficult to maintain a coldwater pool that will support fall-run Chinook salmon spawning in the fall. The peak in fall-run spawning in the American River occurs in mid-November, later than in other Central Valley watersheds, likely because of the coldwater limitations early in the season. Results of the fall-run Chinook salmon egg mortality model are presented in Table 5C.5.2-242. There are negligible differences in egg mortality predicted between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. The main differences are predicted to occur between EBC2 and EBC2_ELT and between EBC2_ELT and EBC2_LLT, which reflect effects of climate change. These results indicate that the ESO would have no effect on egg mortality for fall-run Chinook salmon in the lower American River. These predicted results are consistent with the observation that there are no effects of the BDCP on Folsom Reservoir September storage (Figure 5C.5.2-164), instream flows, or water temperatures (Table 5C.5.2-224, Table 5C.5.2-225) in the American River during the October through January spawning and egg incubation period.

Table 5C.5.2-242. Egg Mortality Percentages for Fall-Run Chinook in the Lower American River under EBC and ESO Scenarios

Water-Year Type	Scenario[a]					
	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Wet	15.1	19.6	30.2	38.8	30.0	39.3
Above Normal	10.5	13.7	24.8	33.0	24.1	32.3
Below Normal	12.3	14.1	24.9	34.5	25.2	33.5
Dry	16.3	17.8	26.0	32.6	25.9	32.4
Critical	20.6	20.8	24.6	30.4	24.6	29.7
All	15.1	17.6	26.8	34.6	26.7	34.4

[a] See Table 5C.0-1 for definitions of scenarios.

Redd Dewatering

Management of instream flows in the American River is largely controlled by reservoir operations and releases. Ramping schedules have been established and are expected to be applied under all model scenarios. Instream flow maintenance and ramping are designed to minimize or avoid the risk of fall-run Chinook salmon redd dewatering. No effect is expected on the risk of redd dewatering as a result of ESO, HOS, or LOS scenarios.

5C.5.2.5.2.2 Fry and Juvenile Rearing

Rearing Habitat

Fall-run Chinook salmon emergence in the American River begins in January, peaks in February, and can continue into April. Juvenile rearing occurs from January to June, with a peak between January and May. Rearing continues later into the summer in years with higher spring flows. Month monthly water temperatures in the American River at Watt Avenue during January through June are predicted to be similar between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT (Table 5C.5.2-224, Table 5C.5.2-225). Further, there would be no differences in mean monthly water temperatures during January through June at Watt Avenue between the ESO scenario and HOS and LOS scenarios (Table 5C.5.2-226, Table 5C.5.2-227). These results suggest that water temperature conditions for fall-run Chinook salmon fry and juvenile rearing under ESO, HOS, and LOS scenarios are expected to remain similar to existing conditions.

Year-round minimum flows of 1,750 cfs for critical habitat features in the American River have been established by NMFS (2009, in prep.) (Table 5C.5.2-9) and used in this effects analysis. Exceedance frequencies for each model scenario are presented in Table 5C.5.2-220 and differences between pairs of scenarios are presented in Table 5C.5.2-221. The exceedances of the 1,750 cfs flow thresholds under ESO_ELT would be similar to exceedances under EBC2_ELT in all water-year types except critical years, in which exceedance would be 36.4% higher under the ESO_ELT. The exceedances of the 1,750 cfs flow thresholds under ESO_LLT would be similar to exceedances under EBC2_LLT in wet, above normal, and below normal water years, and higher in dry and critical years by 7% to 10%. These results indicate the ESO would be beneficial to year-round critical habitat feature maintenance in dry and critical years and would have no effect in other water years.

5C.5.2.5.2.3 Adult

Water Temperature

Adult fall-run Chinook salmon migrate into the American River primarily during September and October. Water temperature modeling (Reclamation Temperature Model) predicts that mean monthly water temperatures in the American River at Watt Avenue during this period would not differ in any month or water-year type between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT (Table 5C.5.2-224, Table 5C.5.2-225). Further, there would be no differences in mean monthly water temperatures during September and October at Watt Avenue between the ESO scenario and HOS and LOS scenarios (Table 5C.5.2-226, Table 5C.5.2-227). These results indicate that there would be no temperature-related effects of ESO, HOS, and LOS scenarios on fall-run Chinook salmon adult migration in the American River. As a result, no further temperature-related biological analyses on fall-run Chinook salmon adult migration in the American River are necessary.

5C.5.2.5.3 Splittail

5C.5.2.5.3.1 Larvae

Splittail spawning and rearing of larvae and young juveniles in channel margin and side-channel habitat upstream of the Delta are likely to be especially important during dry years, when flows are too low to inundate the floodplains. Splittail have been found in the American River as far upstream as a couple of miles beyond the Watt Avenue Bridge (Sommer et al. 2007).

Spawning and Rearing Habitat

The upstream side-channel habitats used by splittail for spawning and rearing are affected by changes in flow because greater flows cause more flooding, thereby increasing availability of such habitat, and because rapid reductions in flow dewater the habitats, potentially stranding splittail eggs and rearing larvae. The use of upstream side-channel habitat is especially important in years with low-flows when floodplains do not inundate. Simulated flows in the American River at its confluence with the Sacramento River were used to investigate the potential effects of BDCP operations on side channel habitat availability on the mainstem American River. This analysis was limited to flows during February through June because these are the most important months for splittail spawning and larval and juvenile rearing and the months in which splittail are most likely to be in the American River.

Average flows by month and water-year type for each model scenario in the American River at the confluence with the Sacramento River are presented in Table 5C.5.2-214 and differences between pairs of model scenarios are presented in Table 5C.5.2-215 respectively. Monthly frequency of exceedance plots of flows during February through June are presented in Figure 5C.5.2-152 through Figure 5C.5.2-156. Results show that, in the drier water-year types (below-normal, dry, and critical) when splittail are most likely to use side channel habitat in the American River, there would be substantial increases in flows between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT in some months. Flows between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT would be minimal during February through April. Differences would be particularly high in May and June; flows would be up to 25% higher under ESO_ELT relative to EBC2_ELT in critical water years. Most differences would be positive. Flows under HOS and LOS scenarios would generally be similar to flows under ESO, except for flows under LOS during June, in which flows would be up to 28% lower depending on water-year type and implementation period (Table 5C.5.2-218, Table 5C.5.2-219). However, despite these reductions, flows under LOS would still be greater than those under EBC2 during June (Table 5C.5.2-214). Overall, these results indicate that similar or greater amounts of side channel habitat would be available for splittail spawning and rearing in the American River under ESO, HOS, and LOS scenarios relative to existing conditions, particularly in May and June.

Water Temperature

Simulated monthly water temperatures (Reclamation Temperature Model) in the American River at the confluence with the Sacramento River were used to investigate the potential effects of BDCP operations on the suitability of water temperatures for splittail larval rearing in the American River. Table 5C.5.2-243 presents predicted year-round mean monthly water temperatures by water-year type in the American River at the confluence with the Sacramento River and Table 5C.5.2-244 presents differences and percent differences between pairs of model scenarios by month and water-year type. These results indicate that there would be very small differences in mean monthly water temperature in the American River at the confluence in all months and water-year types during the February through June rearing period between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. Further, mean monthly water temperatures under HOS and LOS scenarios would not differ from those under ESO regardless of month or water-year type (Table 5C.5.2-245, Table 5C.5.2-246). Because no differences in mean monthly temperatures were found, it was determine that no further temperature analyses on splittail rearing in the American River are necessary.

Table 5C.5.2-243. Mean Monthly Water Temperature (°F) in the American River at the Confluence with the Sacramento River under EBC and ESO Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	47	46	48	50	48	50
	AN	46	46	48	49	48	49
	BN	46	45	47	48	47	48
	D	46	46	47	48	47	48
	C	46	46	48	49	48	49
	All	46	46	47	49	47	49
Feb	W	48	48	50	52	50	52
	AN	48	49	50	52	50	52
	BN	48	48	50	51	49	51
	D	49	50	51	52	51	52
	C	51	51	53	55	53	55
	All	49	49	51	52	51	52
Mar	W	53	53	54	56	54	56
	AN	53	53	55	56	55	56
	BN	54	54	55	56	55	56
	D	55	55	56	58	56	58
	C	56	56	57	59	57	59
	All	54	54	55	57	55	57
Apr	W	57	57	58	60	58	60
	AN	58	58	60	61	60	61
	BN	59	59	60	62	60	62
	D	61	60	62	63	62	63
	C	62	62	63	64	63	65
	All	59	59	60	62	60	62
May	W	61	61	63	66	63	66
	AN	63	63	66	68	66	68
	BN	63	63	65	67	65	67
	D	66	66	68	69	68	68
	C	67	67	68	70	68	70
	All	64	64	66	67	66	67
Jun	W	65	66	68	69	67	68
	AN	68	68	70	71	69	70
	BN	68	68	70	71	69	70
	D	70	70	71	72	70	72
	C	70	70	72	74	72	74
	All	68	68	70	71	69	70
Jul	W	69	69	71	71	70	71
	AN	68	69	69	69	69	69
	BN	68	68	69	70	69	70
	D	69	70	71	72	71	73
	C	73	73	75	76	75	76
	All	69	70	71	72	71	72

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Aug	W	69	69	71	73	72	73
	AN	69	70	71	73	71	73
	BN	70	70	72	73	72	74
	D	69	70	72	74	73	75
	C	72	72	75	77	75	77
	All	70	70	72	74	73	74
Sep	W	66	66	67	69	68	70
	AN	67	67	68	70	68	71
	BN	67	68	69	71	70	71
	D	68	68	69	72	70	72
	C	69	69	71	74	71	74
	All	67	68	69	71	69	71
Oct	W	60	60	63	67	63	66
	AN	60	61	63	67	63	67
	BN	60	60	63	67	63	67
	D	60	61	63	66	63	66
	C	62	62	64	67	64	68
	All	60	61	63	67	63	67
Nov	W	56	56	58	60	58	59
	AN	56	56	58	60	58	59
	BN	55	56	58	59	57	59
	D	56	56	57	59	57	59
	C	57	57	58	60	58	60
	All	56	56	58	59	58	59
Dec	W	49	49	50	52	50	52
	AN	49	49	50	52	50	52
	BN	48	48	49	51	49	51
	D	49	48	50	51	50	51
	C	48	48	49	50	49	50
	All	49	49	50	51	50	51

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-244. Differences[a] between EBC and ESO Scenarios in Mean Monthly Water Temperature (°F) in the American River at the Confluence with the Sacramento River

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	1 (3%)	3 (6.7%)	1 (3.1%)	3 (6.8%)	0 (0%)	0.04 (0.1%)
	AN	1 (2.8%)	3 (5.9%)	1 (2.9%)	3 (6%)	0 (0%)	0 (0%)
	BN	1 (2.9%)	3 (6.3%)	1 (3.1%)	3 (6.5%)	-0.04 (-0.1%)	0.04 (0.1%)
	D	1 (2.5%)	3 (5.6%)	1 (2.8%)	3 (5.8%)	0 (0%)	-0.1 (-0.2%)
	C	1 (3%)	3 (6.7%)	1 (3.2%)	3 (6.8%)	0.04 (0.1%)	0.2 (0.4%)
	All	1 (2.9%)	3 (6.3%)	1 (3%)	3 (6.5%)	0 (0%)	0 (0%)
Feb	W	2 (3.4%)	3 (7%)	2 (3.3%)	3 (6.9%)	0 (0%)	0 (0%)
	AN	2 (3.7%)	4 (7.7%)	2 (3.2%)	3 (7.1%)	-0.04 (-0.1%)	0.04 (0.1%)
	BN	2 (3.3%)	3 (6.6%)	2 (3.2%)	3 (6.5%)	-0.1 (-0.1%)	0.1 (0.1%)
	D	2 (3.2%)	3 (6.2%)	1 (2.9%)	3 (5.9%)	0 (0%)	-0.05 (-0.1%)
	C	1 (2.9%)	3 (6.3%)	2 (3.2%)	3 (6.6%)	0.1 (0.1%)	0.1 (0.1%)
	All	2 (3.3%)	3 (6.7%)	2 (3.1%)	3 (6.6%)	0 (0%)	0 (0%)
Mar	W	1 (2.5%)	3 (5.6%)	1 (2.4%)	3 (5.4%)	0 (0%)	0 (0%)
	AN	1 (2.5%)	3 (5.3%)	1 (2.2%)	3 (5%)	0.04 (0.1%)	0 (0%)
	BN	1 (2.1%)	2 (4.6%)	1.1 (2%)	2 (4.6%)	0 (0%)	0 (0%)
	D	1.4 (2.5%)	3 (5.6%)	1 (2.3%)	3 (5.4%)	-0.1 (-0.2%)	0 (0%)
	C	1 (2%)	3 (4.7%)	1 (2%)	3 (4.7%)	-0.1 (-0.1%)	0.04 (0.1%)
	All	1 (2.4%)	3 (5.2%)	1 (2.2%)	3 (5.1%)	-0.04 (-0.1%)	0 (0%)
Apr	W	1 (2.1%)	3 (4.9%)	1 (2.1%)	3 (4.9%)	0 (0%)	0 (0%)
	AN	1 (2.2%)	3 (5.2%)	1 (2.2%)	3 (5.1%)	0 (0%)	0 (0%)
	BN	1 (2%)	3 (4.9%)	1 (1.9%)	3 (4.8%)	-0.1 (-0.1%)	-0.04 (-0.1%)
	D	1 (1.6%)	3 (4.2%)	1 (2%)	3 (4.6%)	0 (0%)	-0.03 (-0.1%)
	C	1 (1.6%)	3 (4.7%)	1 (1.7%)	3 (4.8%)	-0.3 (-0.5%)	0.2 (0.4%)
	All	1 (1.9%)	3 (4.8%)	1 (2%)	3 (4.8%)	-0.1 (-0.1%)	0 (0%)
May	W	2 (3.6%)	4 (7%)	2 (3.4%)	4 (6.7%)	0 (0%)	-0.1 (-0.1%)
	AN	3 (4.1%)	5 (7.2%)	2 (3.8%)	4 (6.9%)	-0.2 (-0.2%)	-0.3 (-0.5%)
	BN	2 (3.1%)	4 (5.9%)	2 (2.9%)	4 (5.7%)	-0.2 (-0.4%)	-0.4 (-0.6%)
	D	2 (2.9%)	2 (3.6%)	2 (2.8%)	2 (3.5%)	0 (0%)	-1 (-0.9%)
	C	2 (2.3%)	3 (4.8%)	1 (2.1%)	3 (4.6%)	-0.1 (-0.2%)	0.1 (0.1%)
	All	2 (3.2%)	4 (5.7%)	2 (3%)	4 (5.5%)	-0.1 (-0.1%)	-0.3 (-0.4%)
Jun	W	2 (3.1%)	3 (4.4%)	2 (2.8%)	3 (4.1%)	-0.3 (-0.4%)	-1 (-1.2%)
	AN	1 (2%)	2 (3.2%)	1 (1.8%)	2 (3%)	-0.8 (-1.2%)	-1 (-1.2%)
	BN	2 (2.5%)	2 (3.2%)	1 (1.8%)	2 (2.5%)	-0.5 (-0.7%)	-1 (-1.3%)
	D	1 (0.8%)	2 (2.9%)	0.04 (0.1%)	1 (2.1%)	-1 (-1.3%)	-0.5 (-0.7%)
	C	2 (3.3%)	4 (5.4%)	2 (2.7%)	3 (4.7%)	0 (0%)	-0.1 (-0.2%)
	All	2 (2.3%)	3 (3.8%)	1 (1.8%)	2 (3.3%)	-1 (-0.7%)	-1 (-0.9%)
Jul	W	1 (2%)	2 (3.6%)	1 (1.1%)	2 (2.7%)	-1 (-0.9%)	0.1 (0.2%)
	AN	1 (1.4%)	1 (1.9%)	0.4 (0.6%)	1 (1.1%)	0 (0%)	0.3 (0.4%)
	BN	1 (1.7%)	2 (3.4%)	1 (1.2%)	2 (3%)	-0.2 (-0.2%)	0.3 (0.4%)
	D	2 (3%)	4 (6.1%)	1 (2.1%)	4 (5.1%)	0.2 (0.3%)	1 (1.5%)
	C	2 (3.1%)	4 (5.2%)	1 (1.8%)	3 (3.9%)	0.1 (0.2%)	0 (0%)
	All	2 (2.3%)	3 (4.1%)	1 (1.4%)	2 (3.2%)	-0.2 (-0.2%)	0.4 (0.5%)

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Aug	W	2.9 (4.2%)	5 (6.6%)	2 (3.1%)	4 (5.5%)	0.3 (0.5%)	-0.1 (-0.1%)
	AN	1.9 (2.8%)	3 (4.8%)	1.6 (2.3%)	3 (4.3%)	0.1 (0.1%)	-0.04 (-0.1%)
	BN	2 (3%)	4 (6%)	2 (2.2%)	4 (5.1%)	0.2 (0.3%)	1 (1.8%)
	D	4 (5.3%)	5 (7.6%)	3 (4%)	4 (6.3%)	1 (1.2%)	1 (0.8%)
	C	3 (4.3%)	5 (7.5%)	3 (3.8%)	5 (6.9%)	0.1 (0.2%)	0.3 (0.4%)
	All	3 (4.1%)	5 (6.6%)	2 (3.2%)	4 (5.7%)	0.4 (0.5%)	0.4 (0.5%)
Sep	W	2 (2.3%)	4 (5.3%)	1 (2.1%)	3 (5.1%)	1 (0.8%)	0.4 (0.5%)
	AN	1 (2.1%)	4 (6.3%)	1 (2.2%)	4 (6.4%)	0.5 (0.7%)	1 (0.8%)
	BN	2 (3.1%)	4 (5.8%)	2 (2.3%)	3 (5%)	1 (1%)	0.3 (0.4%)
	D	2 (2.9%)	4 (6.6%)	1 (2.1%)	4 (5.8%)	0.2 (0.3%)	-0.2 (-0.3%)
	C	2 (2.7%)	4 (6%)	2 (2.7%)	4 (5.9%)	0 (0%)	0.04 (0.1%)
	All	2 (2.6%)	4 (5.9%)	2 (2.2%)	4 (5.5%)	0.4 (0.6%)	0.2 (0.3%)
Oct	W	4 (5.9%)	7 (11.3%)	3 (4.6%)	6 (9.9%)	0.1 (0.1%)	-0.2 (-0.3%)
	AN	3 (5.4%)	7 (11.4%)	2.8 (4.6%)	6 (10.5%)	0 (0%)	0 (0%)
	BN	3 (5.4%)	8 (12.5%)	3 (4.7%)	7 (11.8%)	0.2 (0.3%)	0.1 (0.1%)
	D	3 (5.3%)	6 (10.3%)	3 (4.5%)	6 (9.4%)	-0.1 (-0.1%)	0.1 (0.2%)
	C	3 (4.3%)	6 (9.3%)	2 (3.4%)	5 (8.3%)	0 (0%)	0.2 (0.2%)
	All	3 (5.4%)	7 (11%)	3 (4.4%)	6 (10%)	0.04 (0.1%)	0 (0%)
Nov	W	2 (2.7%)	3 (5.8%)	1 (2.2%)	3 (5.3%)	-0.3 (-0.4%)	-0.2 (-0.3%)
	AN	2 (3%)	3 (6%)	1 (2.5%)	3 (5.5%)	-0.2 (-0.3%)	-0.1 (-0.2%)
	BN	2 (3.7%)	4 (6.6%)	2 (2.7%)	3 (5.6%)	-0.2 (-0.4%)	-0.2 (-0.3%)
	D	2 (3%)	3 (5.7%)	1 (2.4%)	3 (5.1%)	-0.1 (-0.1%)	-0.1 (-0.1%)
	C	2 (3%)	3 (5.6%)	2 (2.7%)	3 (5.4%)	0.03 (0.1%)	-0.04 (-0.1%)
	All	2 (3%)	3 (5.9%)	1 (2.4%)	3 (5.3%)	-0.2 (-0.3%)	-0.1 (-0.2%)
Dec	W	1 (1.8%)	2 (4.8%)	1 (2.4%)	3 (5.4%)	0 (0%)	-0.1 (-0.2%)
	AN	1 (1.9%)	3 (5.1%)	1 (2.2%)	3 (5.5%)	0 (0%)	0 (0%)
	BN	1 (2.3%)	3 (5.3%)	1 (2.6%)	3 (5.6%)	0 (0%)	-0.03 (-0.1%)
	D	1 (2%)	2 (4.7%)	1 (2.3%)	2 (5%)	-0.05 (-0.1%)	-0.05 (-0.1%)
	C	1 (2.1%)	2 (4.8%)	1 (2.5%)	2 (5.2%)	0.1 (0.3%)	0.1 (0.3%)
	All	1 (2%)	2 (4.9%)	1 (2.4%)	3 (5.3%)	0 (0%)	0 (0%)

[a] Positive values indicate higher water temperature under ESO than under EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-245. Mean Monthly Water Temperature (°F) in the American River at the Confluence with the Sacramento River for ESO, HOS, and LOS Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	48	50	48	50	48	50
	AN	48	49	48	49	48	49
	BN	47	48	47	48	47	49
	D	47	48	47	48	47	48
	C	48	49	48	49	48	49
	All	47	49	47	49	47	49
Feb	W	50	52	50	52	50	52
	AN	50	52	50	52	50	52
	BN	49	51	50	51	50	51
	D	51	52	51	52	51	53
	C	53	55	53	55	53	54
	All	51	52	51	52	51	52
Mar	W	54	56	54	56	54	56
	AN	55	56	55	56	55	56
	BN	55	56	55	56	55	56
	D	56	58	56	58	56	58
	C	57	59	57	59	57	59
	All	55	57	55	57	55	57
Apr	W	58	60	58	60	58	60
	AN	60	61	60	61	60	61
	BN	60	62	60	62	60	62
	D	62	63	62	63	62	63
	C	63	65	63	64	63	64
	All	60	62	60	62	60	62
May	W	63	66	63	66	63	66
	AN	66	68	66	68	66	68
	BN	65	67	65	67	65	67
	D	68	68	68	68	68	68
	C	68	70	68	70	69	70
	All	66	67	66	67	66	67
Jun	W	67	68	68	69	67	68
	AN	69	70	70	71	69	70
	BN	69	70	70	70	69	69
	D	70	72	71	72	70	72
	C	72	74	72	73	72	73
	All	69	70	70	71	69	70
Jul	W	70	71	70	71	70	71
	AN	69	69	69	69	69	69
	BN	69	70	69	70	69	71
	D	71	73	71	73	71	73
	C	75	76	75	76	74	77
	All	71	72	71	72	71	72

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Aug	W	72	73	71	73	72	73
	AN	71	73	71	72	71	73
	BN	72	74	71	73	72	74
	D	73	75	72	74	73	75
	C	75	77	75	77	75	77
	All	73	74	72	74	72	74
Sep	W	68	70	67	69	68	71
	AN	68	71	68	70	69	72
	BN	70	71	70	71	70	71
	D	70	72	70	72	70	72
	C	71	74	71	74	72	74
	All	69	71	69	71	69	72
Oct	W	63	66	63	67	63	66
	AN	63	67	63	67	63	67
	BN	63	67	63	67	63	66
	D	63	66	64	66	63	66
	C	64	68	64	67	64	67
	All	63	67	63	67	63	66
Nov	W	58	59	58	59	58	60
	AN	58	59	58	59	58	59
	BN	57	59	57	59	57	59
	D	57	59	57	59	57	59
	C	58	60	58	60	58	60
	All	58	59	58	59	58	59
Dec	W	50	52	50	52	50	52
	AN	50	52	50	52	50	52
	BN	49	51	50	51	50	51
	D	50	51	50	51	49	51
	C	49	50	49	50	49	50
	All	50	51	50	51	50	51

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

1 **Table 5C.5.2-246. Differences[a] between the ESO Scenarios and HOS and LOS Scenarios in Mean**
2 **Monthly Water Temperature (°F) in the American River at the Confluence with the Sacramento River**

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0.04 (0.1%)	0 (0%)	0.03 (0.1%)	0.1 (0.2%)
	BN	0 (0%)	0 (0%)	0 (0%)	0.1 (0.1%)
	D	0.04 (0.1%)	0.05 (0.1%)	-0.03 (-0.1%)	0 (0%)
	C	0.03 (0.1%)	-0.1 (-0.2%)	0 (0%)	-0.1 (-0.2%)
	All	0.02 (0.1%)	0 (0%)	0 (0%)	0 (0%)
Feb	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	-0.05 (-0.1%)	-0.1 (-0.3%)
	BN	0 (0%)	-0.1 (-0.1%)	0.04 (0.1%)	-0.1 (-0.1%)
	D	0.1 (0.1%)	0 (0%)	0.04 (0.1%)	0.1 (0.1%)
	C	0.1 (0.1%)	-0.2 (-0.3%)	-0.1 (-0.2%)	-0.2 (-0.4%)
	All	0.03 (0.1%)	-0.03 (-0.1%)	0 (0%)	-0.05 (-0.1%)
Mar	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0.1 (0.1%)
	BN	0 (0%)	0.1 (0.1%)	0 (0%)	0 (0%)
	D	0.1 (0.1%)	0 (0%)	0.1 (0.2%)	-0.04 (-0.1%)
	C	0.1 (0.1%)	0 (0%)	0.1 (0.2%)	0 (0%)
	All	0 (0%)	0 (0%)	0.04 (0.1%)	0 (0%)
Apr	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0.1 (0.1%)	0 (0%)	0 (0%)	-0.04 (-0.1%)
	D	0 (0%)	0.1 (0.2%)	0.2 (0.3%)	0 (0%)
	C	0.3 (0.4%)	-0.2 (-0.2%)	0 (0%)	-0.1 (-0.2%)
	All	0.1 (0.1%)	0 (0%)	0.04 (0.1%)	0 (0%)
May	W	0 (0%)	0.1 (0.1%)	0 (0%)	0.03 (0.1%)
	AN	0.1 (0.1%)	0.2 (0.3%)	0 (0%)	0 (0%)
	BN	0.3 (0.4%)	0.5 (0.7%)	0 (0%)	-0.1 (-0.1%)
	D	0 (0%)	0.3 (0.5%)	0 (0%)	0.2 (0.3%)
	C	0.2 (0.3%)	-0.1 (-0.1%)	1 (0.8%)	0 (0%)
	All	0.1 (0.1%)	0.2 (0.3%)	0.1 (0.1%)	0.04 (0.1%)
Jun	W	0.2 (0.3%)	1 (0.9%)	0 (0%)	-0.1 (-0.2%)
	AN	1 (1.4%)	1 (1.7%)	0.1 (0.1%)	0 (0%)
	BN	1 (1%)	1 (0.9%)	-1 (-1%)	-1 (-1.5%)
	D	1 (1.9%)	1 (1%)	0.04 (0.1%)	0.1 (0.2%)
	C	-0.1 (-0.1%)	-1 (-0.8%)	0 (0%)	-1 (-1%)
	All	1 (0.9%)	1 (0.8%)	-0.1 (-0.1%)	-0.3 (-0.4%)
Jul	W	0.1 (0.2%)	-0.1 (-0.1%)	0 (0%)	-0.1 (-0.1%)
	AN	-0.2 (-0.3%)	0.2 (0.2%)	0 (0%)	0.05 (0.1%)
	BN	0.2 (0.4%)	0.1 (0.1%)	0.2 (0.4%)	1 (1.1%)
	D	-0.1 (-0.1%)	-1 (-1%)	-0.4 (-0.6%)	-0.2 (-0.3%)
	C	0.2 (0.3%)	0.1 (0.2%)	-1 (-1.1%)	1 (0.7%)
	All	0.1 (0.1%)	-0.1 (-0.2%)	-0.2 (-0.2%)	0.2 (0.2%)

Month	Water-Year Type[b]	Scenarios[c] ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	-0.2 (-0.3%)	-0.3 (-0.3%)	0 (0%)	0.1 (0.1%)
	AN	-0.4 (-0.5%)	-0.5 (-0.6%)	0 (0%)	0 (0%)
	BN	-1 (-1.5%)	-1 (-1.3%)	-0.1 (-0.2%)	0 (0%)
	D	-1 (-1.1%)	-0.5 (-0.6%)	-0.1 (-0.2%)	0.1 (0.1%)
	C	-0.4 (-0.5%)	-0.1 (-0.1%)	0 (0%)	-0.2 (-0.2%)
	All	-1 (-0.8%)	-0.4 (-0.6%)	-0.1 (-0.1%)	0 (0%)
Sep	W	-0.3 (-0.4%)	-0.3 (-0.5%)	1 (1.1%)	1 (1.6%)
	AN	-0.3 (-0.4%)	-1 (-1%)	1 (0.9%)	0.5 (0.7%)
	BN	0.1 (0.1%)	-0.3 (-0.4%)	0.1 (0.1%)	-0.1 (-0.1%)
	D	-0.2 (-0.2%)	0 (0%)	0 (0%)	0.2 (0.2%)
	C	0 (0%)	-0.1 (-0.1%)	0.2 (0.2%)	-0.1 (-0.1%)
	All	-0.2 (-0.2%)	-0.3 (-0.4%)	0.4 (0.5%)	0.4 (0.6%)
Oct	W	0 (0%)	0 (0%)	-0.1 (-0.1%)	-0.3 (-0.5%)
	AN	0.04 (0.1%)	0.1 (0.2%)	-0.2 (-0.4%)	-0.3 (-0.4%)
	BN	-0.1 (-0.1%)	0 (0%)	-0.2 (-0.3%)	-1 (-1.3%)
	D	0.2 (0.3%)	-0.3 (-0.4%)	-0.2 (-0.4%)	-0.2 (-0.3%)
	C	-0.03 (-0.1%)	-0.2 (-0.3%)	-0.1 (-0.1%)	-0.3 (-0.4%)
	All	0 (0%)	-0.1 (-0.1%)	-0.2 (-0.3%)	-0.4 (-0.6%)
Nov	W	0.1 (0.1%)	0 (0%)	0.05 (0.1%)	0.1 (0.2%)
	AN	0.2 (0.3%)	-0.1 (-0.2%)	-0.1 (-0.1%)	0 (0%)
	BN	0.2 (0.3%)	0.1 (0.2%)	0 (0%)	0.1 (0.2%)
	D	-0.03 (-0.1%)	0.2 (0.3%)	-0.1 (-0.1%)	-0.1 (-0.2%)
	C	0.1 (0.3%)	0.2 (0.3%)	0.1 (0.2%)	0.2 (0.3%)
	All	0.1 (0.1%)	0.1 (0.1%)	0 (0%)	0.1 (0.1%)
Dec	W	0.1 (0.1%)	0.1 (0.2%)	0.1 (0.1%)	0.2 (0.4%)
	AN	0.1 (0.2%)	-0.05 (-0.1%)	0.05 (0.1%)	0.1 (0.2%)
	BN	0.04 (0.1%)	0.1 (0.2%)	0.1 (0.2%)	0.3 (0.5%)
	D	0 (0%)	0.2 (0.4%)	-0.1 (-0.2%)	0.1 (0.2%)
	C	0.2 (0.3%)	0.1 (0.1%)	0.05 (0.1%)	0.1 (0.1%)
	All	0.1 (0.1%)	0.1 (0.2%)	0 (0%)	0.2 (0.3%)

[a] Positive value indicates higher water temperature under HOS or LOS than under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

5C.5.2.5.4 Lamprey

5C.5.2.5.4.1 Eggs

Water Temperature

Exact spawning locations of Pacific and river lamprey in the American River are not well known. Therefore, this analysis includes upstream (Nimbus Dam) and downstream (confluence with the Sacramento River) locations that encompass the range in which those species are thought to spawn (Hannon pers. comm.). Pacific lamprey spawn in the American River during January through August; river lamprey spawn during February through June. Mean monthly temperatures by month and water-year type for Nimbus Dam and the confluence are presented in Table 5C.5.2-247 and Table 5C.5.2-243. Differences for Nimbus and confluence are presented in Table 5C.5.2-248 and Table 5C.5.2-244. These results indicate that water temperatures under ESO_ELT and ESO_LLT at both locations in the American River would be similar to temperatures under EBC2_ELT and EBC2_LLT throughout the January through August period regardless of month or water-year type. Further, there would be no differences in water temperatures between the ESO scenario and HOS and LOS scenarios in either location during February through June (Table 5C.5.2-245, Table 5C.5.2-246, Table 5C.5.2-249, Table 5C.5.2-250).Overall, these results indicate that there would be no temperature-related effects of ESO, HOS, and LOS scenarios on lamprey eggs. As a result, no further water temperature-related biological analyses on lamprey eggs are reported. Because this analysis uses water temperature model outputs based on CALSIM outputs, error has been propagated and the level of certainty of these results is moderate.

Table 5C.5.2-247. Mean Monthly Water Temperature (°F) in the American River at Nimbus Dam under EBC and ESO Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	47	47	48	50	48	50
	AN	47	47	48	49	48	49
	BN	46	46	48	49	48	49
	D	47	46	48	49	48	49
	C	47	47	48	50	48	50
	All	47	47	48	50	48	50
Feb	W	48	48	50	51	50	51
	AN	48	48	50	52	50	52
	BN	47	47	49	51	49	51
	D	49	49	50	52	50	52
	C	51	50	52	54	52	54
	All	48	48	50	52	50	52
Mar	W	52	52	53	55	53	55
	AN	53	53	54	56	54	56
	BN	53	53	54	56	54	56
	D	53	53	55	57	55	57
	C	55	55	56	58	56	58
	All	53	53	54	56	54	56
Apr	W	56	56	57	59	57	59
	AN	57	57	58	60	58	60
	BN	57	58	59	61	59	61
	D	59	59	60	62	60	62
	C	59	59	61	63	60	63
	All	58	57	59	60	59	61
May	W	60	60	62	64	62	64
	AN	61	61	64	66	63	66
	BN	61	61	63	65	63	65
	D	64	64	66	67	66	66
	C	64	65	66	68	66	68
	All	62	62	64	66	64	65
Jun	W	64	64	66	67	65	66

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
	AN	65	66	68	68	67	67
	BN	65	66	67	68	67	67
	D	67	68	68	69	68	68
	C	68	69	71	72	71	72
	All	66	66	68	68	67	68
Jul	W	66	67	68	68	67	68
	AN	66	67	67	66	67	67
	BN	66	66	67	67	67	67
	D	67	67	68	69	68	70
	C	70	71	72	74	73	75
	All	67	68	68	69	68	69
Aug	W	67	67	68	70	69	70
	AN	67	68	69	69	69	70
	BN	67	68	69	69	69	70
	D	67	68	69	71	70	72
	C	70	71	74	76	74	77
	All	67	68	70	71	70	71
Sep	W	65	65	66	68	66	68
	AN	66	66	66	69	66	69
	BN	66	67	67	69	67	69
	D	66	67	68	71	68	71
	C	68	68	71	73	71	73
	All	66	66	67	70	67	70
Oct	W	58	59	63	68	63	67
	AN	59	60	63	68	64	68
	BN	58	59	62	68	63	68
	D	59	60	64	67	64	68
	C	61	62	64	68	64	68
	All	59	60	63	68	63	68
Nov	W	57	57	59	61	59	61
	AN	57	57	59	61	59	61
	BN	56	57	59	61	59	60
	D	57	57	59	61	59	60
	C	58	58	60	61	60	61
	All	57	57	59	61	59	61
Dec	W	50	50	51	53	51	53
	AN	51	50	52	53	52	53
	BN	50	50	51	52	51	52
	D	50	50	51	53	51	53
	C	50	50	51	52	51	52
	All	50	50	51	53	51	53

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-248. Differences[a] between EBC and ESO Scenarios in Mean Monthly Water Temperature (°F) in the American River at Nimbus Dam

Month	Water-Year Type[b]	Scenarios[c] EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	1 (3%)	3 (6.7%)	1 (3.1%)	3 (6.9%)	0 (0%)	0.04 (0.1%)
	AN	1 (2.7%)	3 (5.7%)	1 (2.9%)	3 (5.9%)	0.05 (0.1%)	0 (0%)
	BN	1 (3.1%)	3 (6.5%)	2 (3.3%)	3 (6.7%)	0 (0%)	0.03 (0.1%)
	D	1 (2.7%)	3 (6%)	1 (3%)	3 (6.2%)	0 (0%)	-0.1 (-0.2%)
	C	1 (2.9%)	3 (6.6%)	1 (3.1%)	3 (6.8%)	0 (0%)	0.1 (0.2%)
	All	1 (2.9%)	3 (6.4%)	1 (3.1%)	3 (6.6%)	0 (0%)	0 (0%)
Feb	W	2 (3.5%)	3 (7.2%)	2 (3.3%)	3 (7.1%)	0 (0%)	0 (0%)
	AN	2 (3.8%)	4 (8%)	2 (3.3%)	4 (7.5%)	0 (0%)	0.03 (0.1%)
	BN	2 (3.5%)	3 (7.1%)	2 (3.4%)	3 (7%)	-0.03 (-0.1%)	0.1 (0.1%)
	D	2 (3.3%)	3 (7%)	1 (2.9%)	3 (6.6%)	-0.1 (-0.1%)	0 (0%)
	C	2 (3.1%)	4 (7.1%)	2 (3.7%)	4 (7.7%)	0.2 (0.5%)	0.3 (0.6%)
	All	2 (3.4%)	3 (7.2%)	2 (3.3%)	3 (7.1%)	0 (0%)	0.1 (0.1%)
Mar	W	1 (2.7%)	3 (6%)	1 (2.6%)	3 (5.9%)	0 (0%)	0 (0%)
	AN	1 (2.7%)	3 (5.6%)	1 (2.4%)	3 (5.3%)	0 (0.1%)	0.04 (0.1%)
	BN	1 (2.4%)	3 (5.1%)	1.3 (2.5%)	3 (5.1%)	0 (0%)	0.1 (0.1%)
	D	1.5 (2.9%)	3 (6.3%)	1 (2.7%)	3 (6.1%)	-0.1 (-0.2%)	-0.1 (-0.1%)
	C	1 (2.1%)	3 (5.5%)	1 (2.3%)	3 (5.7%)	-0.3 (-0.5%)	0.03 (0.1%)
	All	1 (2.6%)	3 (5.8%)	1 (2.5%)	3 (5.7%)	-0.1 (-0.1%)	0 (0%)
Apr	W	1 (2.2%)	3 (5.3%)	1 (2.2%)	3 (5.3%)	0 (0%)	0 (0%)
	AN	1 (2.3%)	3 (5.5%)	1 (2.3%)	3 (5.6%)	0 (0%)	0 (0%)
	BN	1 (2.3%)	3 (5.4%)	1 (2.2%)	3 (5.3%)	-0.1 (-0.1%)	-0.04 (-0.1%)
	D	1 (1.4%)	3 (4.3%)	1 (2.4%)	3 (5.3%)	0.1 (0.1%)	0 (0%)
	C	1 (1.6%)	4 (6.2%)	1 (1.8%)	4 (6.4%)	-1 (-1%)	0.5 (0.7%)
	All	1 (2%)	3 (5.3%)	1 (2.2%)	3 (5.5%)	-0.1 (-0.1%)	0.1 (0.1%)
May	W	2 (3.5%)	4 (6.9%)	2 (3.3%)	4 (6.7%)	0 (0%)	0 (-0.1%)
	AN	2 (3.9%)	4 (7.4%)	2 (3.7%)	4 (7.2%)	-0.1 (-0.2%)	-0.3 (-0.4%)
	BN	2 (3.2%)	4 (6.4%)	2 (3.1%)	4 (6.3%)	-0.2 (-0.3%)	-0.2 (-0.3%)
	D	2 (2.9%)	2 (3.7%)	2 (2.9%)	2 (3.6%)	0.2 (0.2%)	-1 (-1%)
	C	1 (2.3%)	4 (5.9%)	1 (1.9%)	4 (5.5%)	-0.3 (-0.5%)	0.1 (0.2%)
	All	2 (3.2%)	4 (6%)	2 (3%)	4 (5.8%)	-0.1 (-0.1%)	-0.2 (-0.3%)
Jun	W	2 (2.7%)	2 (3.8%)	2 (2.4%)	2 (3.5%)	-0.2 (-0.3%)	-1 (-0.9%)
	AN	2 (2.3%)	2 (3.2%)	1 (1.9%)	2 (2.9%)	-1 (-0.9%)	-1 (-1%)
	BN	2 (2.7%)	2 (3.3%)	1 (2%)	2 (2.6%)	-0.4 (-0.5%)	-1 (-1.2%)
	D	0.6 (0.9%)	1 (2.1%)	-0.2 (-0.3%)	1 (1%)	-1 (-1.2%)	-0.4 (-0.6%)
	C	3 (3.9%)	4 (6.1%)	2 (2.4%)	3 (4.7%)	0 (0%)	-0.1 (-0.1%)
	All	2 (2.4%)	2 (3.6%)	1 (1.7%)	2 (2.9%)	-0.4 (-0.6%)	-1 (-0.8%)
Jul	W	1 (1.5%)	1 (2.2%)	0 (0.6%)	1 (1.2%)	-1 (-0.8%)	0 (0%)
	AN	0.7 (1%)	1 (1%)	0.2 (0.2%)	0 (0.2%)	0.1 (0.1%)	0.2 (0.3%)
	BN	1 (1.1%)	1 (2.2%)	0 (0.5%)	1 (1.5%)	-0.1 (-0.2%)	0.3 (0.4%)
	D	2 (2.5%)	4 (5.4%)	1 (1.5%)	3 (4.3%)	0.3 (0.4%)	1 (1.9%)
	C	3 (4%)	5 (6.9%)	2 (2.1%)	4 (4.9%)	0.4 (0.6%)	0.4 (0.6%)
	All	1 (2%)	2 (3.5%)	1 (0.9%)	2 (2.4%)	-0.1 (-0.1%)	0.4 (0.6%)

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Aug	W	2.2 (3.2%)	3 (4.6%)	1 (2%)	2 (3.4%)	0.3 (0.4%)	-0.1 (-0.1%)
	AN	1.5 (2.2%)	2 (3.3%)	1 (1.4%)	2 (2.5%)	0.05 (0.1%)	0.1 (0.2%)
	BN	2 (2.6%)	3 (4.5%)	1 (1.4%)	2 (3.3%)	0.2 (0.2%)	1 (1.8%)
	D	3 (4.5%)	5 (7.1%)	2 (3%)	4 (5.6%)	1 (1.1%)	1 (0.8%)
	C	4 (5.9%)	7 (9.8%)	4 (5.2%)	6 (9.1%)	0.3 (0.5%)	1 (0.8%)
	All	2 (3.7%)	4 (5.8%)	2 (2.5%)	3 (4.6%)	0.4 (0.5%)	0.4 (0.6%)
Sep	W	1 (1.7%)	3 (4.4%)	1 (1.3%)	3 (4%)	0.3 (0.5%)	0.2 (0.3%)
	AN	1 (1.3%)	4 (5.9%)	1 (1.2%)	4 (5.8%)	0.4 (0.6%)	1 (1.2%)
	BN	1 (2.1%)	3 (4.4%)	1 (1.2%)	2 (3.4%)	1 (0.9%)	0.1 (0.2%)
	D	2 (2.8%)	4 (6.7%)	1 (1.9%)	4 (5.8%)	0.5 (0.7%)	-1 (-0.8%)
	C	2 (3.3%)	5 (7.1%)	2 (3.3%)	5 (7.1%)	-0.05 (-0.1%)	0.04 (0.1%)
	All	1 (2.2%)	4 (5.5%)	1 (1.7%)	3 (5%)	0.4 (0.5%)	0.1 (0.1%)
Oct	W	5 (8.2%)	9 (15.5%)	4 (6.2%)	8 (13.4%)	0.1 (0.1%)	-0.3 (-0.4%)
	AN	4 (7.2%)	9 (14.9%)	3.7 (6.2%)	8 (13.9%)	0.1 (0.2%)	0.1 (0.2%)
	BN	4 (7.4%)	10 (16.8%)	4 (6.3%)	9 (15.6%)	0.3 (0.5%)	0.1 (0.1%)
	D	4 (7.6%)	8 (14.3%)	4 (6.3%)	8 (12.9%)	-0.1 (-0.2%)	0.1 (0.2%)
	C	4 (6%)	7 (12.3%)	3 (4.3%)	7 (10.5%)	-0.04 (-0.1%)	0.1 (0.2%)
	All	4 (7.5%)	9 (14.9%)	4 (6%)	8 (13.3%)	0.1 (0.1%)	0 (0%)
Nov	W	2 (3.3%)	4 (6.5%)	1 (2.6%)	3 (5.8%)	-0.2 (-0.3%)	-0.1 (-0.2%)
	AN	2 (3.4%)	4 (6.5%)	2 (2.8%)	3 (5.9%)	-0.04 (-0.1%)	-0.1 (-0.2%)
	BN	3 (4.6%)	4 (7.6%)	2 (3.4%)	4 (6.3%)	-0.1 (-0.2%)	-0.1 (-0.2%)
	D	2 (3.7%)	4 (6.6%)	2 (2.9%)	3 (5.8%)	-0.1 (-0.1%)	-0.1 (-0.1%)
	C	2 (3.5%)	4 (6.1%)	2 (3%)	3 (5.6%)	0.05 (0.1%)	-0.1 (-0.1%)
	All	2 (3.6%)	4 (6.7%)	2 (2.9%)	3 (5.9%)	-0.1 (-0.2%)	-0.1 (-0.2%)
Dec	W	1 (1.9%)	3 (5.1%)	1 (2.4%)	3 (5.6%)	0 (0%)	-0.04 (-0.1%)
	AN	1 (2.1%)	3 (5.3%)	1 (2.4%)	3 (5.6%)	0.1 (0.1%)	0 (0%)
	BN	1 (2.4%)	3 (5.4%)	1 (2.6%)	3 (5.6%)	0 (0%)	-0.03 (-0.1%)
	D	1.1 (2.1%)	3 (5.2%)	1 (2.4%)	3 (5.5%)	-0.04 (-0.1%)	-0.1 (-0.1%)
	C	1 (2.2%)	3 (5.1%)	1 (2.5%)	3 (5.4%)	0.1 (0.2%)	0 (0%)
	All	1 (2.1%)	3 (5.2%)	1 (2.5%)	3 (5.6%)	0 (0%)	-0.03 (-0.1%)

[a] Positive values indicate higher water temperature under ESO than under EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

1 **Table 5C.5.2-249. Mean Monthly Water Temperature (°F) in the American River at Nimbus Dam for**
2 **ESO, HOS, and LOS Scenarios**

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	48	50	48	50	48	50
	AN	48	49	48	50	48	50
	BN	48	49	48	49	48	49
	D	48	49	48	49	48	49
	C	48	50	48	50	48	50
	All	48	50	48	50	48	50
Feb	W	50	51	50	51	50	51
	AN	50	52	50	52	50	52
	BN	49	51	49	51	49	51
	D	50	52	50	52	50	52
	C	52	54	52	54	52	54
	All	50	52	50	52	50	52
Mar	W	53	55	53	55	53	55
	AN	54	56	54	56	54	56
	BN	54	56	54	56	54	56
	D	55	57	55	57	55	56
	C	56	58	56	58	56	58
	All	54	56	54	56	54	56
Apr	W	57	59	57	59	57	59
	AN	58	60	58	60	58	60
	BN	59	61	59	61	59	61
	D	60	62	60	62	60	62
	C	60	63	61	63	61	63
	All	59	61	59	60	59	61
May	W	62	64	62	64	62	64
	AN	63	66	63	66	63	66
	BN	63	65	63	65	63	65
	D	66	66	66	67	66	67
	C	66	68	66	68	67	68
	All	64	65	64	66	64	65
Jun	W	65	66	66	67	65	66
	AN	67	67	68	69	67	67
	BN	67	67	67	68	66	66
	D	68	68	69	69	68	69
	C	71	72	70	72	71	71
	All	67	68	68	68	67	68
Jul	W	67	68	68	68	67	68
	AN	67	67	67	67	67	67
	BN	67	67	67	67	67	68
	D	68	70	68	69	68	70
	C	73	75	73	74	72	75
	All	68	69	68	69	68	69

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Aug	W	69	70	68	69	69	70
	AN	69	70	69	69	69	69
	BN	69	70	68	69	69	71
	D	70	72	69	71	70	72
	C	74	77	73	77	74	77
	All	70	71	69	71	70	71
Sep	W	66	68	66	68	67	68
	AN	66	69	66	69	67	70
	BN	67	69	68	69	67	69
	D	68	71	68	71	68	71
	C	71	73	71	73	71	73
	All	67	70	67	69	68	70
Oct	W	63	67	63	67	63	67
	AN	64	68	64	68	63	68
	BN	63	68	63	68	62	67
	D	64	68	64	67	63	67
	C	64	68	64	68	64	68
	All	63	68	63	68	63	67
Nov	W	59	61	59	61	59	61
	AN	59	61	59	61	59	61
	BN	59	60	59	61	59	61
	D	59	60	59	61	59	60
	C	60	61	60	61	60	61
	All	59	61	59	61	59	61
Dec	W	51	53	51	53	51	53
	AN	52	53	52	53	52	53
	BN	51	52	51	53	51	53
	D	51	53	51	53	51	53
	C	51	52	51	53	51	53
	All	51	53	51	53	51	53

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-250. Differences[a] between the ESO Scenarios and HOS and LOS Scenarios in Mean Monthly Water Temperature (°F) in the American River at Nimbus Dam

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0.04 (0.1%)	0.03 (0.1%)	0.05 (0.1%)	0.1 (0.2%)
	BN	0 (0%)	0.05 (0.1%)	0 (0%)	0.1 (0.1%)
	D	0 (0%)	0.1 (0.1%)	0 (0%)	0 (0%)
	C	0.1 (0.2%)	-0.04 (-0.1%)	0 (0%)	-0.04 (-0.1%)
	All	0.03 (0.1%)	0 (0%)	0 (0%)	0 (0%)
Feb	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0.03 (0.1%)	-0.03 (-0.1%)	-0.1 (-0.2%)
	BN	0 (0%)	-0.04 (-0.1%)	0.04 (0.1%)	-0.1 (-0.1%)
	D	0.1 (0.1%)	0 (0%)	0.1 (0.2%)	0.1 (0.1%)
	C	0.1 (0.3%)	-0.4 (-0.8%)	-0.2 (-0.3%)	-0.5 (-0.9%)
	All	0.04 (0.1%)	-0.1 (-0.1%)	0 (0%)	-0.1 (-0.2%)
Mar	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	-0.05 (-0.1%)	0 (0%)	0.1 (0.1%)
	BN	0 (0%)	0.05 (0.1%)	0.05 (0.1%)	0 (0%)
	D	0 (0%)	0.04 (0.1%)	0.1 (0.2%)	-0.1 (-0.1%)
	C	0.2 (0.4%)	-0.03 (-0.1%)	0.3 (0.5%)	-0.1 (-0.2%)
	All	0.03 (0.1%)	0 (0%)	0.1 (0.1%)	0 (0%)
Apr	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0.1 (0.1%)	0 (0%)	0 (0%)	-0.04 (-0.1%)
	D	0 (0%)	0.1 (0.1%)	0.4 (0.6%)	0.2 (0.3%)
	C	1 (1.2%)	-1 (-0.8%)	0.2 (0.3%)	-0.3 (-0.6%)
	All	0.1 (0.2%)	-0.1 (-0.1%)	0.1 (0.2%)	0 (0%)
May	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0.05 (0.1%)	0.1 (0.2%)	0 (0%)	0 (0%)
	BN	0.2 (0.2%)	0.3 (0.5%)	0 (0%)	-0.1 (-0.2%)
	D	0.03 (0.1%)	0.4 (0.6%)	0.1 (0.1%)	0.3 (0.5%)
	C	0.1 (0.1%)	-0.1 (-0.2%)	1 (1.2%)	0 (0%)
	All	0.05 (0.1%)	0.2 (0.2%)	0.1 (0.2%)	0.1 (0.1%)
Jun	W	0.1 (0.2%)	0.5 (0.7%)	0 (0%)	-0.1 (-0.1%)
	AN	1 (1.2%)	1 (1.6%)	0.1 (0.1%)	0 (0%)
	BN	0.5 (0.7%)	0.4 (0.6%)	-1 (-1.1%)	-1 (-1.4%)
	D	1 (1.9%)	1 (1%)	0 (0%)	0.1 (0.2%)
	C	-0.2 (-0.3%)	-1 (-0.7%)	0.2 (0.3%)	-1 (-1%)
	All	0.5 (0.7%)	0.4 (0.7%)	-0.1 (-0.1%)	-0.3 (-0.4%)
Jul	W	0.1 (0.2%)	0 (0%)	0 (0%)	-0.05 (-0.1%)
	AN	-0.2 (-0.3%)	0.1 (0.2%)	0 (0%)	0 (0%)
	BN	0.2 (0.3%)	0 (0%)	0.2 (0.3%)	1 (1%)
	D	-0.04 (-0.1%)	-1 (-1.4%)	-0.3 (-0.5%)	-0.3 (-0.4%)
	C	0 (0%)	-0.5 (-0.6%)	-1 (-1.2%)	0.4 (0.5%)
	All	0.04 (0.1%)	-0.3 (-0.4%)	-0.2 (-0.2%)	0.1 (0.1%)

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	-0.2 (-0.3%)	-0.2 (-0.3%)	0 (0%)	0.1 (0.2%)
	AN	-0.3 (-0.5%)	-0.3 (-0.5%)	0 (0%)	0 (0%)
	BN	-1 (-1.4%)	-1 (-1.4%)	-0.2 (-0.3%)	0.2 (0.3%)
	D	-1 (-1.3%)	-1 (-0.9%)	0 (0%)	-0.1 (-0.2%)
	C	-1 (-1.5%)	-0.2 (-0.2%)	-0.2 (-0.2%)	-0.4 (-0.5%)
	All	-1 (-0.9%)	-0.5 (-0.6%)	-0.1 (-0.1%)	0 (0%)
Sep	W	-0.1 (-0.2%)	-0.2 (-0.2%)	1 (0.9%)	1 (0.9%)
	AN	-0.2 (-0.3%)	-1 (-1.2%)	1 (0.8%)	0.3 (0.4%)
	BN	0.3 (0.4%)	-0.3 (-0.5%)	0.1 (0.2%)	-0.1 (-0.2%)
	D	-0.4 (-0.6%)	0.2 (0.3%)	0.1 (0.1%)	0.3 (0.5%)
	C	0.1 (0.1%)	-0.1 (-0.1%)	0.2 (0.3%)	-0.2 (-0.3%)
	All	-0.1 (-0.1%)	-0.2 (-0.3%)	0.3 (0.5%)	0.3 (0.4%)
Oct	W	0.04 (0.1%)	0 (0%)	-0.2 (-0.2%)	-1 (-0.8%)
	AN	0 (0%)	0.3 (0.4%)	-0.4 (-0.6%)	-0.4 (-0.6%)
	BN	-0.1 (-0.2%)	0.1 (0.1%)	-0.3 (-0.5%)	-1 (-2%)
	D	0.2 (0.3%)	-0.3 (-0.4%)	-0.3 (-0.4%)	-0.3 (-0.5%)
	C	-0.03 (-0.1%)	-0.3 (-0.5%)	-0.1 (-0.1%)	-1 (-0.8%)
	All	0 (0%)	-0.1 (-0.1%)	-0.2 (-0.4%)	-1 (-0.9%)
Nov	W	0.1 (0.2%)	0.1 (0.1%)	0 (0%)	0.2 (0.3%)
	AN	0.1 (0.2%)	0 (0%)	-0.1 (-0.1%)	0.1 (0.1%)
	BN	0.1 (0.2%)	0.2 (0.3%)	0 (0%)	0.2 (0.3%)
	D	0 (0%)	0.1 (0.2%)	0 (0%)	0 (-0.1%)
	C	0.2 (0.4%)	0.2 (0.3%)	0.1 (0.2%)	0.2 (0.3%)
	All	0.1 (0.2%)	0.1 (0.2%)	0 (0%)	0.1 (0.2%)
Dec	W	0.05 (0.1%)	0.1 (0.1%)	0.1 (0.1%)	0.2 (0.3%)
	AN	0 (0%)	0 (0%)	0 (0.1%)	0.1 (0.2%)
	BN	0.2 (0.4%)	0.1 (0.2%)	0.1 (0.1%)	0.2 (0.4%)
	D	0.2 (0.4%)	0.2 (0.3%)	-0.04 (-0.1%)	0.03 (0.1%)
	C	0.1 (0.2%)	0.1 (0.3%)	0 (0%)	0.1 (0.2%)
	All	0.1 (0.1%)	0.1 (0.2%)	0.03 (0.1%)	0.1 (0.3%)

[a] Positive values indicate higher water temperature under HOS or LOS than under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Redd Dewatering

To determine the effects of the ESO on redd dewatering risk to Pacific and river lamprey in the American River, the number and frequency of redd "cohorts" experiencing a month-over-month (from one month to the next) decrease in flow of greater than 50%, which is assumed here to represent a redd dewatering event, below Nimbus Dam and at the confluence with the Sacramento River was determined from CALSIM model outputs. Small-scale spawning location suitability characteristics (e.g., depth, velocity, and substrate) for lamprey are not adequately described to enable a more formal analysis, such as a weighted usable area analysis. Therefore, the change in month-over-month flows was used as a surrogate a month-over-month flow reduction of 50% was chosen as a best professional estimate of conditions in which redd dewatering is expected to occur, but this value does not estimate empirically-derived redd dewatering events. A "cohort" of eggs was assumed to be "born" every month during either January through August for Pacific lamprey or February through June for river lamprey. Because flows under HOS and LOS scenarios would be generally similar to those under ESO, the redd dewatering risk analysis was not conducted on HOS and LOS.

Results of the dewatering risk for Pacific lamprey are presented in Table 5C.5.2-91 and differences between pairs of model scenarios in redd dewatering risk are presented in Table 5C.5.2-92. The total number of redd cohorts that would experience a 50% month-over-month flow decrease would be slightly higher under ESO_ELT than under EBC2_ELT in the American River below Nimbus Dam (5% higher) and at the confluence with the Sacramento River (7% higher), respectively. The number of redd cohorts that would experience a 50% month-over-month flow decrease would be similar at both locations between EBC2_LLT and ESO_LLT. These results indicate that there would be a small negative effect of the ESO on redd dewatering during the ELT, but no effect of the ESO during the LLT.

Results of the dewatering risk for river lamprey are presented in Table 5C.5.2-93 and differences between pairs of model scenarios in redd dewatering risk are presented in Table 5C.5.2-94. The total number of redd cohorts that would experience a 50% month-over-month flow decrease under ESO_ELT would be 8% lower than the number under EBC2_ELT below Nimbus Dam and identical at the confluence with the Sacramento River. The total number of redd cohorts that would experience a 50% month-over-month flow decrease under ESO_LLT would be 6% higher than the number under EBC2_LLT below Nimbus Dam and no different at the confluence with the Sacramento River. These results indicate that there would generally be a small benefit in the ELT and small negative effect in the LLT upstream below Nimbus Dam and no effect downstream at the confluence with the Sacramento River regardless of implementation period.

Because neither the exact locations of Pacific and river lamprey redds nor flow-WUA relationships for Pacific and river lamprey were used in this analysis, these results represent a relative estimate of redd dewatering among model scenarios. Therefore, there is low certainty in these conclusions.

5C.5.2.5.4.2 Ammocoete

Water Temperature

Pacific lamprey ammocoetes rear in the American River for five to seven years. River lamprey rear in the American River for three to five years. The potential year-round water temperature effects of the ESO on lamprey ammocoetes were evaluated using Reclamation Temperature Model outputs for below Nimbus Dam and at the confluence with the Sacramento River. Mean monthly temperatures by month and water-year type for Nimbus Dam and the confluence are presented in Table 5C.5.2-247 and Table 5C.5.2-243, respectively. Differences for Nimbus and confluence are presented in Table 5C.5.2-247 and Table 5C.5.2-243, respectively. These results indicate that water temperatures under ESO_ELT and ESO_LLT at both locations in the American River would be similar to temperatures under EBC2_ELT and EBC2_LLT year-round regardless of month or water-year type. Further, there would be no differences in water temperatures between the ESO scenario and HOS and LOS scenarios in either location throughout the year (Table 5C.5.2-245, Table 5C.5.2-246, Table 5C.5.2-249, Table 5C.5.2-250).Therefore, there would be no temperature-related effects of ESO, HOS, or LOS scenarios on lamprey ammocoetes. As a result, no further water temperature-related biological analyses on lamprey ammocoetes are reported. Because this analysis uses water temperature model outputs based on CALSIM outputs, error has been propagated and the level of certainty of these results is moderate.

Stranding

To determine the effects of the ESO on ammocoete stranding risk to Pacific and river lamprey in the American River, the number and frequency of ammocoete "cohorts" experiencing a month-over-month decrease in flow ranging from greater than 50% to greater than 90% below Nimbus Dam and at the confluence with the Sacramento River was determined from CALSIM model outputs. The range of flow reductions was 50–90% (in 5% increments) and included the range in which model scenarios were distinguishable and indistinguishable from one another. For Pacific lamprey, a "cohort" of ammocoetes was assumed to be "born" every month during their spawning period (January–August) and spend five years rearing upstream. For river lamprey, cohorts were assumed to be born every month during February through June and spend five years rearing upstream. A cohort was considered "stranded" if at least one month-over-month flow reduction was greater than the each flow reduction at any time during the seven-year (for Pacific lamprey) or five-year rearing period (for river lamprey). Because flows under HOS and LOS scenarios would be generally similar to those under ESO, the stranding risk analysis was not conducted on HOS and LOS.

Below Nimbus Dam

The number of Pacific lamprey ammocoete cohorts that may be stranded by month-over-month flow reductions in the American River below Nimbus Dam are presented in Figure 5C.5.2-165, and differences between model scenarios are presented in Table 5C.5.2-251. Differences in the number of Pacific lamprey ammocoetes exposed to flow reductions between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT are predicted to generally be negligible for the 50% to 70% flow reduction range. At the 75% and 80% flow reductions, ammocoete stranding risk under ESO_ELT would be 12% and 23% higher, respectively, than those under EBC2_ELT. There would be no difference in ammocoete stranding risk between EBC2_ELT and ESO_ELT in the 85% and 90% flow reductions. Ammocoete stranding risk would be 7% higher under ESO_LLT relative to EBC2_LLT for the 75% reduction, but 11% to 25% lower for the 80% to 90% flow reduction range. These results indicate that there is generally no difference in Pacific lamprey stranding risk under the ESO except at higher flow reductions, at which, ammocoete stranding risk under the ESO would be higher than risk under EBC2 during the ELT and lower during the LLT.

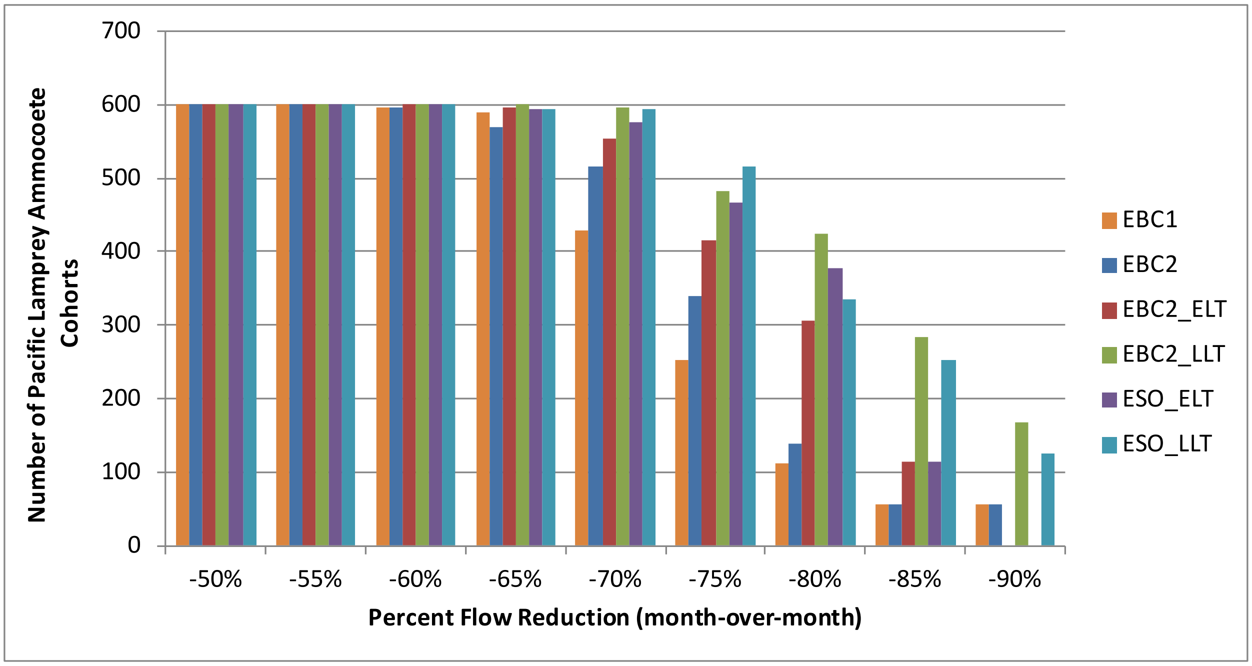

Figure 5C.5.2-165. Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions of 50% to 90%, American River at Nimbus Dam, under EBC and ESO Scenarios

Table 5C.5.2-251. Differences between EBC and ESO Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, American River at Nimbus Dam

Flow Reduction	Percent Difference inScenarios[a, b]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
50%	0	0	0	0	0	0
55%	0	0	0	0	0	0
60%	1	1	1	1	0	0
65%	1	1	4	4	-1	-1
70%	34	39	11	15	4	-1
75%	85	104	37	52	12	7
80%	238	200	172	142	23	-21
85%	104	352	104	352	0	-11
90%	-100	125	-100	125	NA	-25

[a] Negative values indicate reduced cohort exposure under ESO.
[b] See Table 5C.0-1 for definitions of the scenarios.
NA = Could not be calculated because dividing by 0.

The number of river lamprey ammocoete cohorts that may be stranded by month-over-month flow reductions in the American River at Nimbus Dam is presented in Figure 5C.5.2-166, and differences between model scenarios are presented in Table 5C.5.2-252. Differences in the number of river lamprey ammocoetes exposed to flow reductions between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT are predicted to generally be negligible for the 50% to 70% flow reduction range. At the 75% and 80% flow reductions, ammocoete stranding risk under ESO_ELT would be 19% and 22% higher, respectively, than those under EBC2_ELT. There would be no difference in ammocoete stranding risk between EBC2_ELT and ESO_ELT in the 85% and 90% flow reductions. Ammocoete stranding risk would be 9% higher under ESO_LLT relative to EBC2_LLT for the 75% reduction, but 8% to 24% lower for the 80% to 90% flow reduction range. These results indicate that there is generally no difference in river lamprey stranding risk under the ESO except at higher flow reductions, at which, ammocoete stranding risk under the ESO would be mostly higher than risk under EBC2 during the ELT and lower during the LLT.

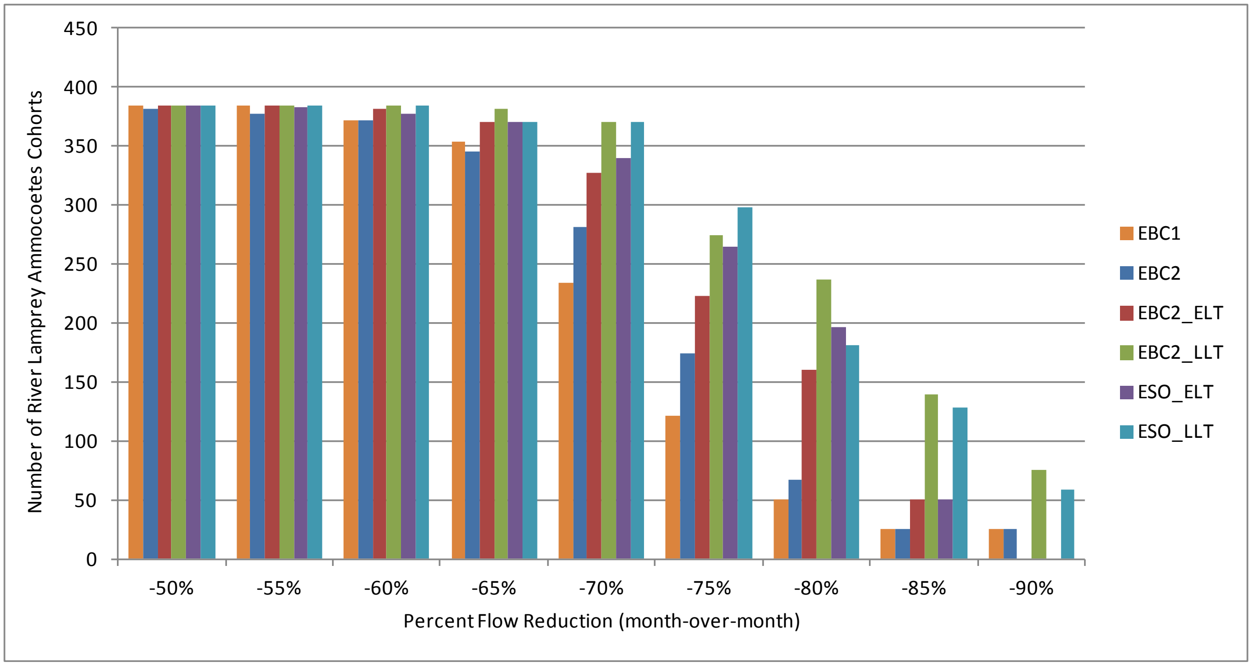

Figure 5C.5.2-166. Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions of 50% to 90%, American River at Nimbus Dam, under EBC and ESO Scenarios

Table 5C.5.2-252. Differences between EBC and ESO Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, American River at Nimbus Dam

Flow Reduction	Percent Difference between Scenarios[a, b]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
50%	0	0	1	1	0	0
55%	-1	0	2	2	-1	0
60%	2	4	2	4	-1	0
65%	5	5	7	7	0	-3
70%	45	59	21	32	4	0.3
75%	119	146	51	70	19	9
80%	292	262	193	170	22	-24
85%	100	416	100	416	0.0	-8
90%	-100	136	-100	136	NA	-21

[a] Negative values indicate reduced cohort exposure, a benefit of the ESO.
[b] See Table 5C.0-1 for definitions of the scenarios.
NA = Could not be calculated because dividing by 0.

At Confluence with the Sacramento River

The number of Pacific lamprey ammocoete cohorts that may be stranded by month-over-month flow reductions in the American River at the confluence with the Sacramento River is presented in Figure 5C.5.2-167, and differences between model scenarios are presented in Table 5C.5.2-253. Differences in the number of river lamprey ammocoetes exposed to flow reductions between EBC2_ELT and ESO_ELT are predicted to generally be negligible for the entire flow reductions range, except for the 85% reduction at which ammocoete stranding risk is predicted to be 33% higher under the ESO_ELT. Differences in the number of river lamprey ammocoetes exposed to flow reductions between EBC2_LLT and ESO_LLT are predicted to be negligible for the 50% to 70% flow reduction range. At the 75% and 80% flow reductions, ammocoete stranding risk under ESO_LLT would be 7% and 17% higher, respectively, than those under EBC2_LLT. At the 85% and 90% flow reductions, ammocoete stranding risk under ESO_LLT would be 18% and 12% lower, respectively, than those under EBC2_LLT. These results indicate that there is generally no difference in Pacific lamprey stranding risk under the ESO except at higher flow reductions, at which, ammocoete stranding risk under the ESO would be higher than risk under EBC2 during the ELT and both higher and lower during the LLT depending on flow reduction.

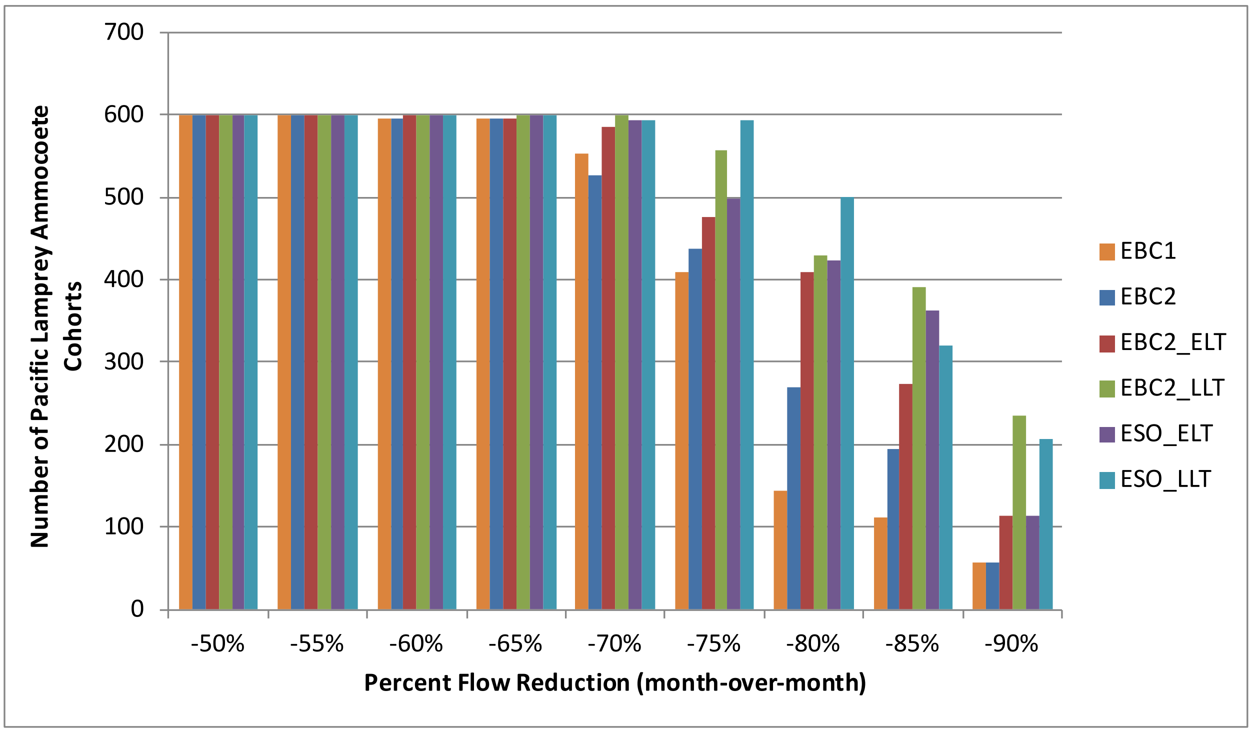

Figure 5C.5.2-167. Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions of 50% to 90%, American River at the Confluence with the Sacramento River, under EBC and ESO Scenarios

Table 5C.5.2-253. Differences between EBC and ESO Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, American River at the Confluence with the Sacramento River

Flow Reduction	Percent Difference between Scenarios[a, b]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
50%	0	0	0	0	0	0
55%	0	0	0	0	0	0
60%	0.7	0.7	0.7	0.7	0	0
65%	0.8	0.8	0.8	0.8	0.7	0
70%	7.0	7.0	12.5	12.5	1.2	-1.2
75%	21.8	45.0	13.7	35.4	4.4	6.5
80%	192.4	245.5	57.0	85.6	3.7	16.8
85%	223.2	185.7	85.6	64.1	32.6	-18.4
90%	103.6	267.9	103.6	267.9	0.0	-12.3

[a] Positive values indicate increased cohort exposure under ESO.
[b] See Table 5C.0-1 for definitions of the scenarios.

The number of river lamprey ammocoete cohorts that may be affected by month-over-month flow reductions in the American River at the confluence with the Sacramento River is presented in Figure 5C.5.2-168, and differences between model scenarios are presented in Table 5C.5.2-254. Differences in the number of river lamprey ammocoetes exposed to flow reductions between EBC2_ELT and ESO_ELT are predicted to generally be negligible throughout the flow reduction range except for the 80% and 85% flow reductions, at which stranding risk would be 9% and 32% higher, respectively under the ESO_ELT compared to that under the EBC2_ELT. Differences in the number of river lamprey ammocoetes exposed to flow reductions between EBC2_LLT and ESO_LLT are predicted to be negligible at the 50% to 70% flow reduction range. Ammocoete stranding risk would be 11% and 25% higher under ESO_LLT relative to EBC2_LLT for the 75% and 80% flow reductions, respectively, but 21% to 14% lower for the 85% and 90% flow reductions, respectively. These results indicate that there is generally no difference in river lamprey stranding risk under the ESO except at higher flow reductions, at which, ammocoete stranding risk under the ESO would be higher and lower than risk under EBC2 during the ELT and lower during the LLT.

Overall, the results of the analysis of stranding risk are similar for Pacific and river lamprey. There would be no effect of the ESO on stranding risk for the majority of flow reductions evaluated. At higher flow reductions, stranding risk would be higher in the ELT and higher and lower under the LLT depending on the species, location, and flow reduction.

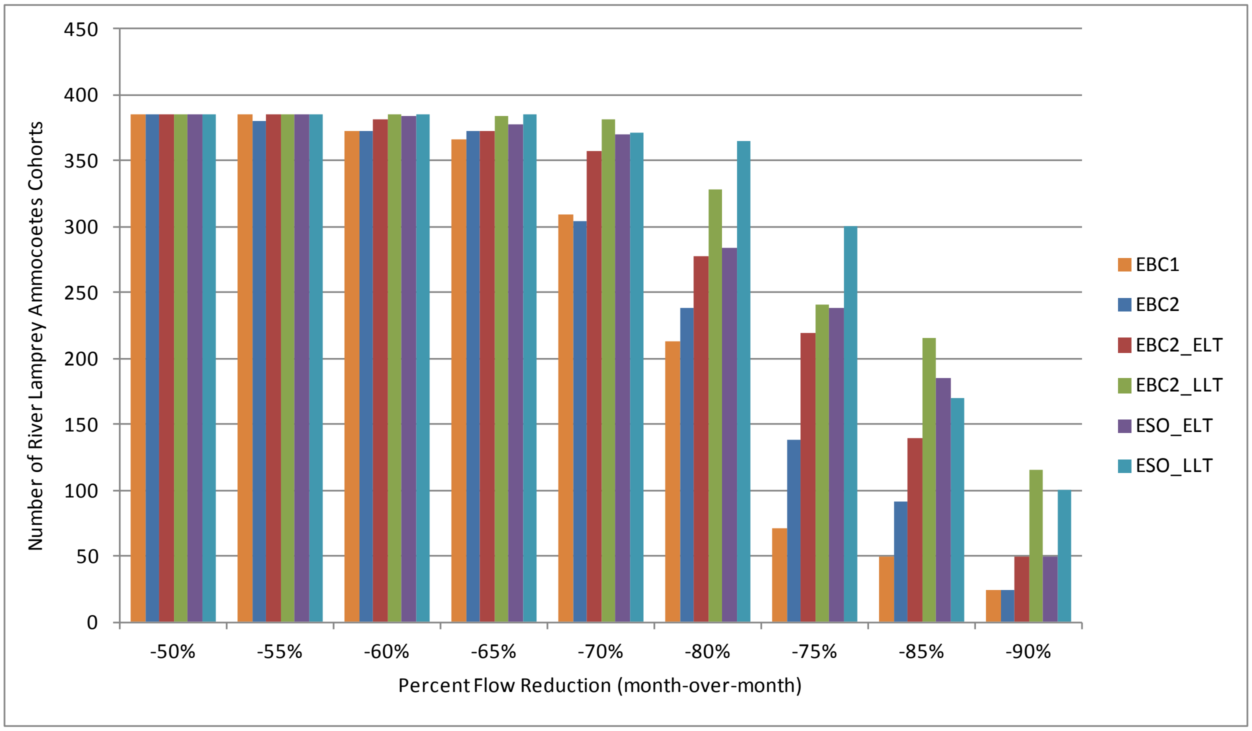

Figure 5C.5.2-168. Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions of 50% to 90%, American River at the Confluence with the Sacramento River, under EBC and ESO Scenarios

Table 5C.5.2-254. Differences between EBC and ESO Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, American River at the Confluence with the Sacramento River

Flow Reduction	Percent Difference between Scenarios[a, b]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
50%	0.0	0.0	0	0	0	0
55%	0.0	0.0	1.3	1.3	0	0
60%	3.2	3.5	3.2	3.5	0.5	0
65%	3.3	5.2	1.6	3.5	1.6	0.3
70%	19.7	20.1	21.7	22.0	3.6	-2.6
75%	33.3	71.4	19.3	53.4	2.2	11.3
80%	235.2	322.5	72.5	117.4	8.7	24.5
85%	270.0	240.0	101.1	84.8	32.1	-20.9
90%	100.0	300.0	100.0	300.0	0	-13.8

[a] Positive values indicate increased cohort exposure under ESO.

[b] See Table 5C.0-1 for definitions of the scenarios.

5C.5.2.6 Mainstem San Joaquin River

5C.5.2.6.1 Steelhead

5C.5.2.6.1.1 Eggs and Alevins

Upstream Spawning Habitat

The mainstem San Joaquin River does not provide habitat for steelhead spawning or egg incubation. Therefore, changes in flow associated with BDCP operations on the San Joaquin River would have no effect on steelhead spawning or egg incubation.

5C.5.2.6.1.2 Fry and Juvenile Rearing

Rearing Habitat

Juvenile steelhead rear and migrate through the lower San Joaquin River during the spring (primarily January through April) during their downstream movement from the tributary spawning and rearing habitat to coastal marine waters. Results of CALSIM modeling of San Joaquin River flows are summarized, by month and water-year type for all months, in Table 5C.5.2-255 and differences between pairs of model scenarios are presented in Table 5C.5.2-256. Results of the monthly frequency of exceedance analysis for San Joaquin River flows for each month are shown in Figure 5C.5.2-169 through Figure 5C.5.2-180, and specifically during the January through April juvenile steelhead migration period in Figure 5C.5.2-169 through Figure 5C.5.2-173. Flows in the San Joaquin River at Vernalis are not predicted to differ in a biologically meaningful way (less than a 5% difference) between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. Further, flows under HOS and LOS scenarios would not differ from flows under ESO during the January through April steelhead rearing and smolt downstream migration period (Table 5C.5.2-257, Table 5C.5.2-258). Based on these results, it was concluded that ESO, HOS, and LOS scenarios would not affect instream habitat conditions on the lower San Joaquin River for steelhead juvenile rearing or smolt downstream migration.

Table 5C.5.2-255. Mean Monthly Flows (cfs) in the San Joaquin River at Vernalis, under EBC and ESO Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	9,089	9,004	9,838	9,681	9,884	9,675
	AN	5,447	5,370	5,781	6,011	5,809	6,037
	BN	2,326	2,252	2,291	2,220	2,298	2,207
	D	2,270	2,214	2,247	2,202	2,219	2,266
	C	1,667	1,607	1,603	1,592	1,597	1,572
	AVG	4,777	4,705	5,040	5,018	5,054	5,025
Feb	W	12,750	12,605	14,001	13,191	14,000	13,182
	AN	6,965	6,837	7,100	6,721	7,072	6,701
	BN	2,983	2,885	2,965	2,841	2,933	2,841
	D	2,590	2,447	2,312	2,269	2,312	2,245
	C	2,120	1,953	1,942	1,941	1,942	1,942
	AVG	6,388	6,250	6,699	6,361	6,688	6,351
Mar	W	14,374	14,262	15,127	15,235	15,129	15,236
	AN	6,284	6,180	6,252	6,364	6,252	6,365
	BN	2,949	2,751	2,614	2,476	2,614	2,476
	D	2,479	2,361	2,191	2,146	2,191	2,146
	C	1,813	1,689	1,689	1,688	1,689	1,688
	AVG	6,648	6,520	6,739	6,763	6,739	6,763
Apr	W	11,955	11,895	12,185	12,457	12,189	12,460
	AN	6,014	5,980	5,970	6,042	5,970	6,042
	BN	4,490	4,445	4,161	3,922	4,162	3,923
	D	3,656	3,624	3,380	3,112	3,380	3,112
	C	1,983	1,932	1,844	1,796	1,844	1,796
	AVG	6,351	6,305	6,286	6,291	6,288	6,291
May	W	12,109	12,064	13,210	12,632	13,213	12,633
	AN	5,381	5,380	5,278	5,092	5,279	5,092
	BN	4,074	4,024	3,871	3,657	3,874	3,659
	D	3,308	3,265	3,040	2,823	3,041	2,823
	C	1,964	1,896	1,819	1,798	1,819	1,797
	AVG	6,148	6,106	6,347	6,069	6,348	6,069
Jun	W	11,058	11,046	9,255	6,820	9,252	6,820
	AN	2,965	2,928	2,782	2,678	2,783	2,679
	BN	2,051	2,007	1,960	1,870	1,964	1,873
	D	1,537	1,470	1,361	1,291	1,362	1,292
	C	1,020	980	975	956	976	956
	AVG	4,583	4,547	3,969	3,206	3,969	3,207
Jul	W	7,654	7,730	5,903	4,345	5,904	4,347
	AN	1,958	1,927	1,806	1,801	1,811	1,804
	BN	1,491	1,436	1,432	1,381	1,439	1,386
	D	1,295	1,205	1,146	1,100	1,147	1,101
	C	898	883	869	858	870	858
	AVG	3,239	3,229	2,658	2,184	2,661	2,186

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Aug	W	3,539	3,522	3,051	2,645	3,052	2,646
	AN	2,000	1,989	1,764	1,699	1,768	1,702
	BN	1,460	1,426	1,423	1,375	1,429	1,378
	D	1,375	1,339	1,272	1,225	1,272	1,226
	C	1,007	1,018	993	987	993	987
	AVG	2,072	2,056	1,858	1,710	1,860	1,712
Sep	W	3,519	3,475	3,306	3,127	3,306	3,128
	AN	2,355	2,338	2,221	2,164	2,223	2,166
	BN	1,829	1,804	1,800	1,748	1,802	1,750
	D	1,796	1,770	1,691	1,643	1,692	1,643
	C	1,402	1,407	1,392	1,378	1,392	1,379
	AVG	2,338	2,314	2,226	2,144	2,227	2,145
Oct	W	2,760	2,748	2,714	2,726	2,714	2,712
	AN	2,745	2,720	2,638	2,595	2,638	2,595
	BN	2,502	2,481	2,412	2,348	2,412	2,348
	D	2,945	2,942	2,849	2,790	2,849	2,791
	C	2,213	2,190	2,162	2,031	2,163	2,031
	AVG	2,639	2,622	2,565	2,515	2,565	2,511
Nov	W	2,534	2,495	2,516	2,411	2,516	2,418
	AN	3,182	3,151	3,232	3,193	3,254	3,123
	BN	2,150	2,120	2,180	1,997	2,222	1,997
	D	2,272	2,244	2,244	2,217	2,290	2,253
	C	1,968	1,944	1,911	1,898	1,911	1,898
	AVG	2,448	2,416	2,441	2,367	2,459	2,361
Dec	W	4,370	4,351	4,835	4,504	4,868	4,492
	AN	4,711	4,604	4,917	4,567	5,001	4,643
	BN	2,182	2,151	2,099	2,065	2,135	2,075
	D	2,129	2,100	2,072	2,166	2,085	2,186
	C	1,729	1,704	1,689	1,694	1,686	1,683
	AVG	3,219	3,178	3,366	3,211	3,399	3,225

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

1 **Table 5C.5.2-256. Differences[a] between EBC and ESO Scenarios in Mean Monthly Flows in the San**
2 **Joaquin River at Vernalis**

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	795 (8.7%)	586 (6.4%)	880 (9.8%)	671 (7.4%)	45 (0.5%)	-7 (-0.1%)
	AN	362 (6.7%)	590 (10.8%)	440 (8.2%)	667 (12.4%)	28 (0.5%)	26 (0.4%)
	BN	-28 (-1.2%)	-119 (-5.1%)	46 (2.1%)	-45 (-2%)	7 (0.3%)	-13 (-0.6%)
	D	-51 (-2.3%)	-4 (-0.2%)	5 (0.2%)	52 (2.3%)	-28 (-1.2%)	65 (2.9%)
	C	-70 (-4.2%)	-95 (-5.7%)	-9 (-0.6%)	-34 (-2.1%)	-5 (-0.3%)	-19 (-1.2%)
	All	277 (5.8%)	249 (5.2%)	350 (7.4%)	321 (6.8%)	15 (0.3%)	8 (0.2%)
Feb	W	1249 (9.8%)	432 (3.4%)	1395 (11.1%)	578 (4.6%)	-2 (-0.01%)	-9 (-0.1%)
	AN	108 (1.5%)	-264 (-3.8%)	235 (3.4%)	-136 (-2%)	-28 (-0.4%)	-20 (-0.3%)
	BN	-50 (-1.7%)	-141 (-4.7%)	48 (1.7%)	-44 (-1.5%)	-32 (-1.1%)	1 (0.02%)
	D	-278 (-10.8%)	-345 (-13.3%)	-135 (-5.5%)	-201 (-8.2%)	0 (0%)	-24 (-1.1%)
	C	-178 (-8.4%)	-178 (-8.4%)	-11 (-0.6%)	-11 (-0.6%)	0 (0%)	1 (0.1%)
	All	300 (4.7%)	-37 (-0.6%)	438 (7%)	101 (1.6%)	-11 (-0.2%)	-10 (-0.2%)
Mar	W	755 (5.2%)	861 (6%)	867 (6.1%)	973 (6.8%)	2 (0.01%)	0 (0%)
	AN	-33 (-0.5%)	80 (1.3%)	72 (1.2%)	185 (3%)	0 (0%)	0 (0%)
	BN	-335 (-11.4%)	-473 (-16%)	-137 (-5%)	-275 (-10%)	0 (0%)	0 (0%)
	D	-288 (-11.6%)	-333 (-13.4%)	-170 (-7.2%)	-215 (-9.1%)	0 (0%)	0 (0%)
	C	-124 (-6.8%)	-125 (-6.9%)	-1 (0%)	-2 (-0.1%)	0 (0%)	0 (0%)
	All	92 (1.4%)	116 (1.7%)	219 (3.4%)	243 (3.7%)	1 (0.01%)	0 (0%)
Apr	W	234 (2%)	505 (4.2%)	294 (2.5%)	565 (4.8%)	4 (0.04%)	3 (0.02%)
	AN	-45 (-0.7%)	28 (0.5%)	-10 (-0.2%)	63 (1%)	0 (0%)	0 (0%)
	BN	-329 (-7.3%)	-567 (-12.6%)	-284 (-6.4%)	-523 (-11.8%)	0 (0%)	0 (0%)
	D	-277 (-7.6%)	-545 (-14.9%)	-245 (-6.7%)	-512 (-14.1%)	0 (0%)	0 (0%)
	C	-139 (-7%)	-187 (-9.4%)	-88 (-4.6%)	-136 (-7.1%)	0 (0%)	0 (0%)
	All	-63 (-1%)	-60 (-0.9%)	-17 (-0.3%)	-13 (-0.2%)	1 (0.02%)	1 (0.01%)
May	W	1104 (9.1%)	524 (4.3%)	1149 (9.5%)	569 (4.7%)	3 (0.02%)	1 (0.01%)
	AN	-103 (-1.9%)	-289 (-5.4%)	-102 (-1.9%)	-288 (-5.4%)	1 (0.02%)	0 (0%)
	BN	-200 (-4.9%)	-415 (-10.2%)	-150 (-3.7%)	-365 (-9.1%)	3 (0.1%)	2 (0.1%)
	D	-268 (-8.1%)	-485 (-14.7%)	-224 (-6.9%)	-442 (-13.5%)	0 (0%)	1 (0.02%)
	C	-145 (-7.4%)	-168 (-8.5%)	-77 (-4.1%)	-99 (-5.2%)	0 (0%)	-1 (-0.04%)
	All	201 (3.3%)	-78 (-1.3%)	242 (4%)	-37 (-0.6%)	2 (0.03%)	1 (0.01%)
Jun	W	-1805 (-16.3%)	-4238 (-38.3%)	-1794 (-16.2%)	-4226 (-38.3%)	-3 (-0.04%)	0 (0%)
	AN	-181 (-6.1%)	-285 (-9.6%)	-144 (-4.9%)	-248 (-8.5%)	1 (0.04%)	2 (0.1%)
	BN	-86 (-4.2%)	-178 (-8.7%)	-42 (-2.1%)	-134 (-6.7%)	4 (0.2%)	3 (0.2%)
	D	-176 (-11.4%)	-245 (-16%)	-109 (-7.4%)	-178 (-12.1%)	1 (0.1%)	1 (0.1%)
	C	-45 (-4.4%)	-64 (-6.3%)	-4 (-0.4%)	-24 (-2.4%)	1 (0.1%)	0 (0%)
	All	-614 (-13.4%)	-1376 (-30%)	-578 (-12.7%)	-1340 (-29.5%)	0 (0%)	1 (0.03%)
Jul	W	-1750 (-22.9%)	-3307 (-43.2%)	-1826 (-23.6%)	-3382 (-43.8%)	1 (0.01%)	2 (0.1%)
	AN	-147 (-7.5%)	-153 (-7.8%)	-116 (-6%)	-123 (-6.4%)	5 (0.3%)	3 (0.2%)
	BN	-52 (-3.5%)	-105 (-7.1%)	3 (0.2%)	-50 (-3.5%)	8 (0.5%)	5 (0.4%)
	D	-149 (-11.5%)	-194 (-15%)	-58 (-4.8%)	-104 (-8.6%)	1 (0.1%)	1 (0.1%)
	C	-29 (-3.2%)	-40 (-4.4%)	-14 (-1.5%)	-25 (-2.8%)	1 (0.1%)	0.4 (0.1%)
	All	-578 (-17.9%)	-1053 (-32.5%)	-569 (-17.6%)	-1043 (-32.3%)	3 (0.1%)	2 (0.1%)

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Aug	W	-487 (-13.8%)	-892 (-25.2%)	-471 (-13.4%)	-876 (-24.9%)	1 (0.03%)	2 (0.1%)
	AN	-233 (-11.6%)	-299 (-14.9%)	-222 (-11.1%)	-288 (-14.5%)	4 (0.2%)	2 (0.1%)
	BN	-31 (-2.1%)	-81 (-5.6%)	3 (0.2%)	-47 (-3.3%)	6 (0.4%)	4 (0.3%)
	D	-102 (-7.4%)	-149 (-10.8%)	-66 (-5%)	-113 (-8.4%)	1 (0.1%)	1 (0.1%)
	C	-14 (-1.4%)	-20 (-2%)	-25 (-2.4%)	-31 (-3%)	1 (0.1%)	0 (0%)
	All	-212 (-10.2%)	-360 (-17.4%)	-196 (-9.5%)	-344 (-16.7%)	2 (0.1%)	2 (0.1%)
Sep	W	-213 (-6.1%)	-391 (-11.1%)	-169 (-4.9%)	-347 (-10%)	-1 (-0.02%)	1 (0.03%)
	AN	-131 (-5.6%)	-189 (-8%)	-115 (-4.9%)	-173 (-7.4%)	2 (0.1%)	1 (0.1%)
	BN	-27 (-1.5%)	-79 (-4.3%)	-2 (-0.1%)	-54 (-3%)	3 (0.2%)	2 (0.1%)
	D	-105 (-5.8%)	-153 (-8.5%)	-78 (-4.4%)	-127 (-7.2%)	0 (0%)	0 (0%)
	C	-11 (-0.8%)	-23 (-1.7%)	-15 (-1.1%)	-28 (-2%)	0 (0%)	1 (0.1%)
	All	-111 (-4.7%)	-193 (-8.2%)	-88 (-3.8%)	-169 (-7.3%)	1 (0.03%)	1 (0.05%)
Oct	W	-45 (-1.6%)	-47 (-1.7%)	-34 (-1.2%)	-36 (-1.3%)	0 (0%)	-14 (-0.5%)
	AN	-107 (-3.9%)	-150 (-5.4%)	-82 (-3%)	-124 (-4.6%)	0 (0%)	0 (0%)
	BN	-90 (-3.6%)	-154 (-6.1%)	-68 (-2.8%)	-132 (-5.3%)	1 (0.02%)	0 (0%)
	D	-95 (-3.2%)	-154 (-5.2%)	-93 (-3.2%)	-151 (-5.1%)	0 (0%)	1 (0.03%)
	C	-50 (-2.3%)	-182 (-8.2%)	-27 (-1.2%)	-159 (-7.2%)	0 (0%)	0 (0%)
	All	-73 (-2.8%)	-127 (-4.8%)	-57 (-2.2%)	-111 (-4.2%)	0 (0%)	-4 (-0.1%)
Nov	W	-18 (-0.7%)	-116 (-4.6%)	21 (0.8%)	-77 (-3.1%)	0 (0%)	6 (0.3%)
	AN	72 (2.3%)	-59 (-1.8%)	103 (3.3%)	-27 (-0.9%)	22 (0.7%)	-70 (-2.2%)
	BN	72 (3.3%)	-154 (-7.1%)	102 (4.8%)	-123 (-5.8%)	42 (1.9%)	0 (0%)
	D	18 (0.8%)	-19 (-0.8%)	46 (2%)	8 (0.4%)	46 (2%)	35 (1.6%)
	C	-57 (-2.9%)	-70 (-3.6%)	-33 (-1.7%)	-46 (-2.4%)	0 (0%)	0 (0%)
	All	12 (0.5%)	-86 (-3.5%)	43 (1.8%)	-55 (-2.3%)	18 (0.7%)	-6 (-0.3%)
Dec	W	498 (11.4%)	122 (2.8%)	517 (11.9%)	141 (3.2%)	33 (0.7%)	-12 (-0.3%)
	AN	290 (6.2%)	-68 (-1.4%)	397 (8.6%)	39 (0.8%)	84 (1.7%)	76 (1.7%)
	BN	-46 (-2.1%)	-107 (-4.9%)	-15 (-0.7%)	-76 (-3.5%)	36 (1.7%)	10 (0.5%)
	D	-44 (-2%)	57 (2.7%)	-15 (-0.7%)	86 (4.1%)	13 (0.6%)	20 (0.9%)
	C	-43 (-2.5%)	-46 (-2.7%)	-17 (-1%)	-21 (-1.2%)	-3 (-0.2%)	-11 (-0.6%)
	All	180 (5.6%)	5 (0.2%)	221 (6.9%)	46 (1.5%)	33 (1%)	14 (0.4%)

[a] Positive values indicate higher flows under ESO than under EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

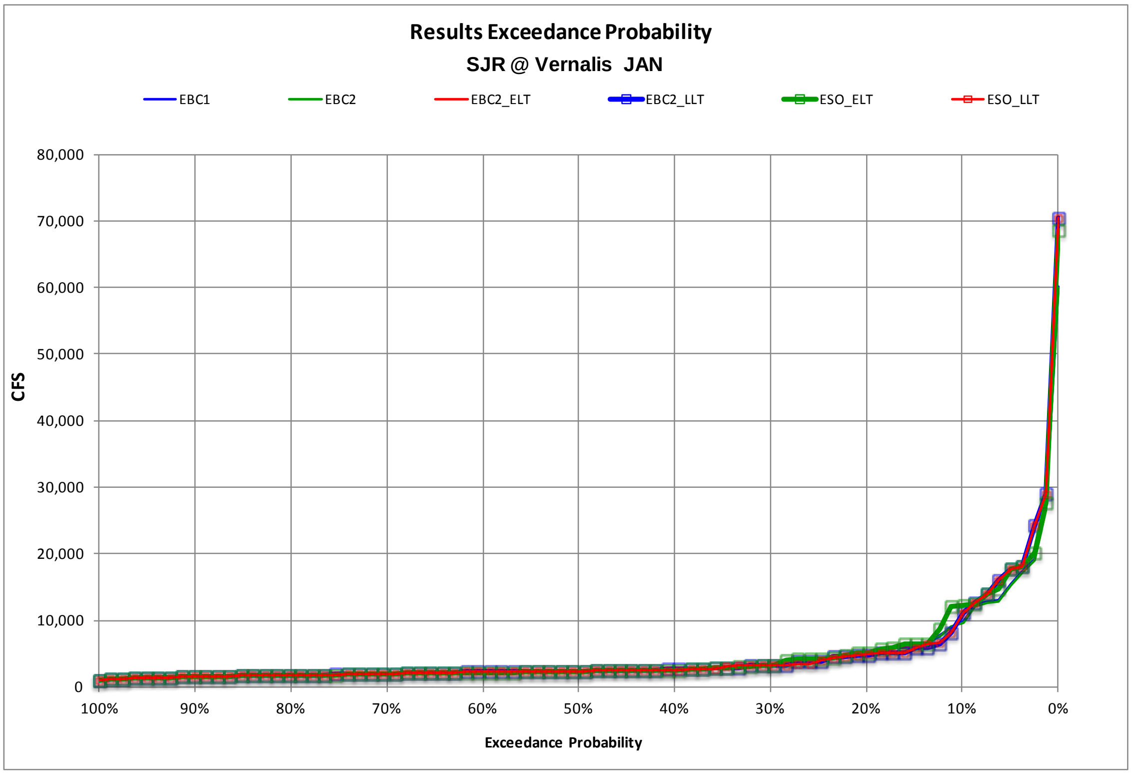

Figure 5C.5.2-169. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow Rate of San Joaquin River at Vernalis, January

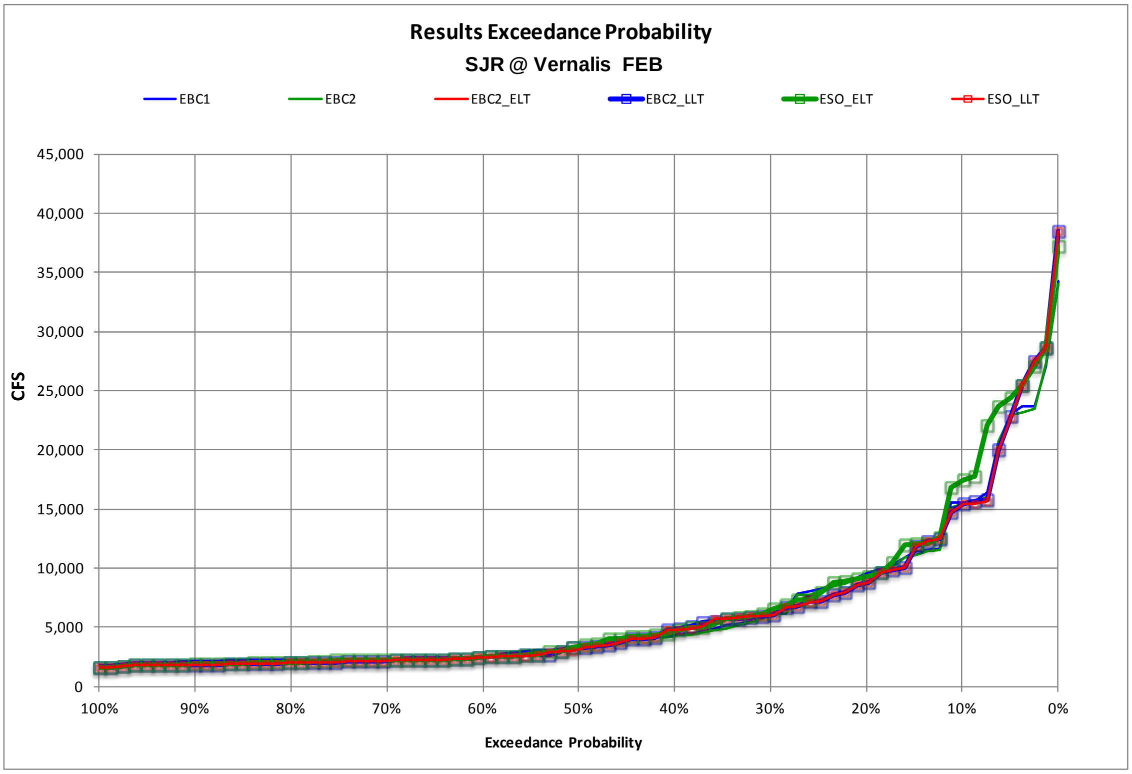

Figure 5C.5.2-170. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow Rate of San Joaquin River at Vernalis, February

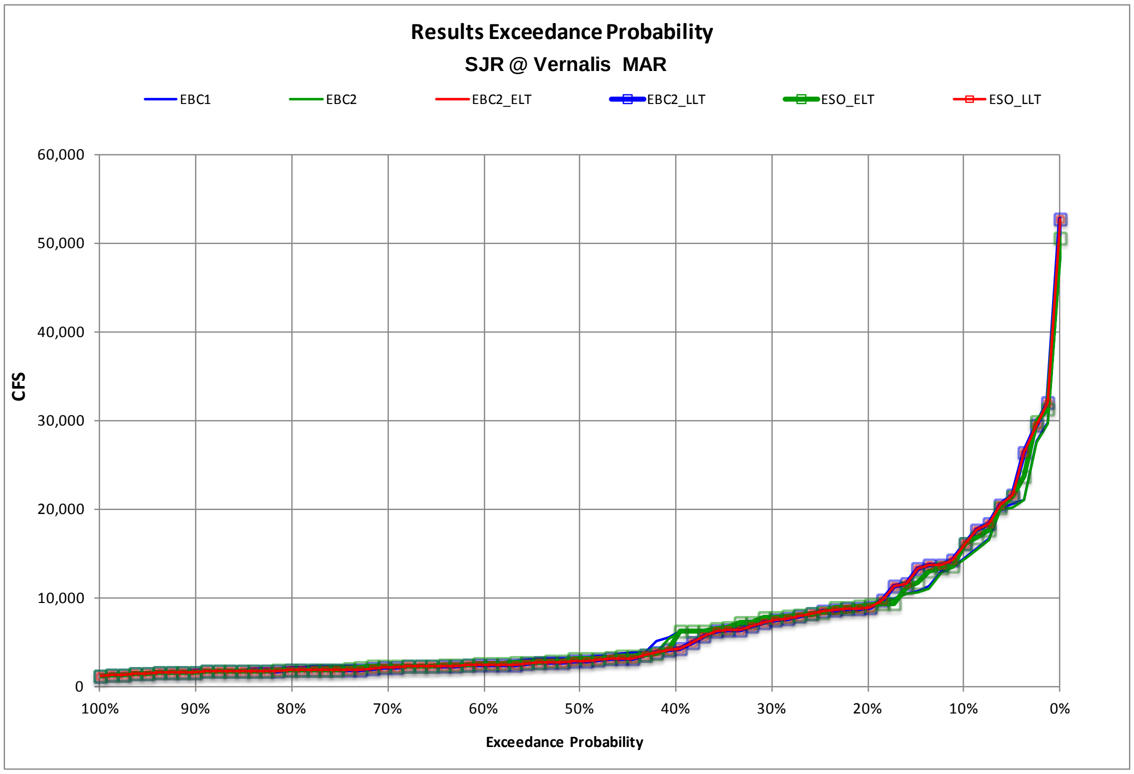

Figure 5C.5.2-171. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow Rate of San Joaquin River at Vernalis, March

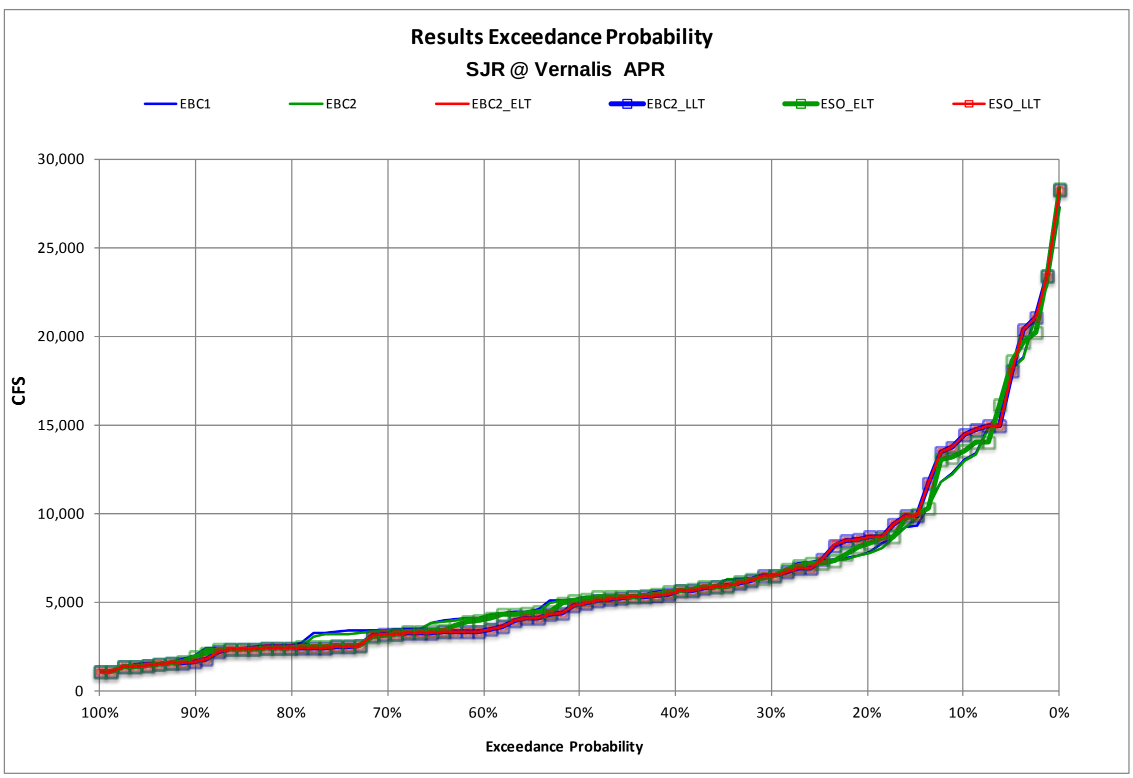

Figure 5C.5.2-172. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow Rate of San Joaquin River at Vernalis, April

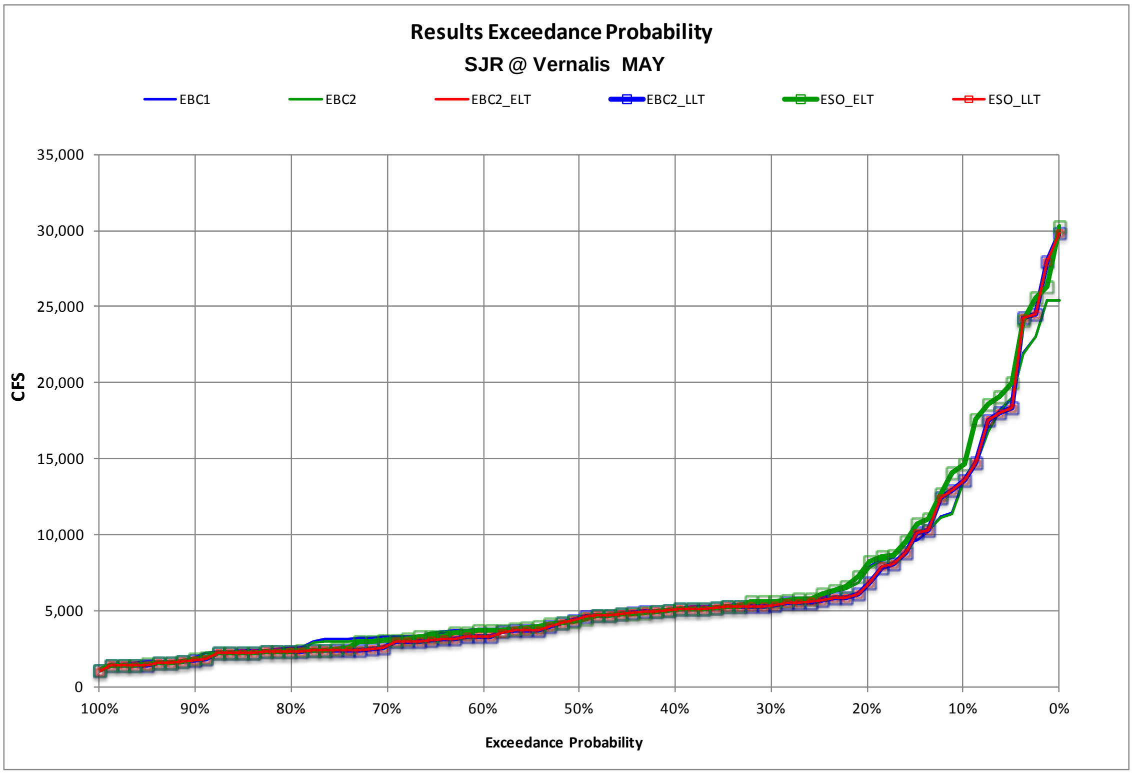

Figure 5C.5.2-173. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow Rate of San Joaquin River at Vernalis, May

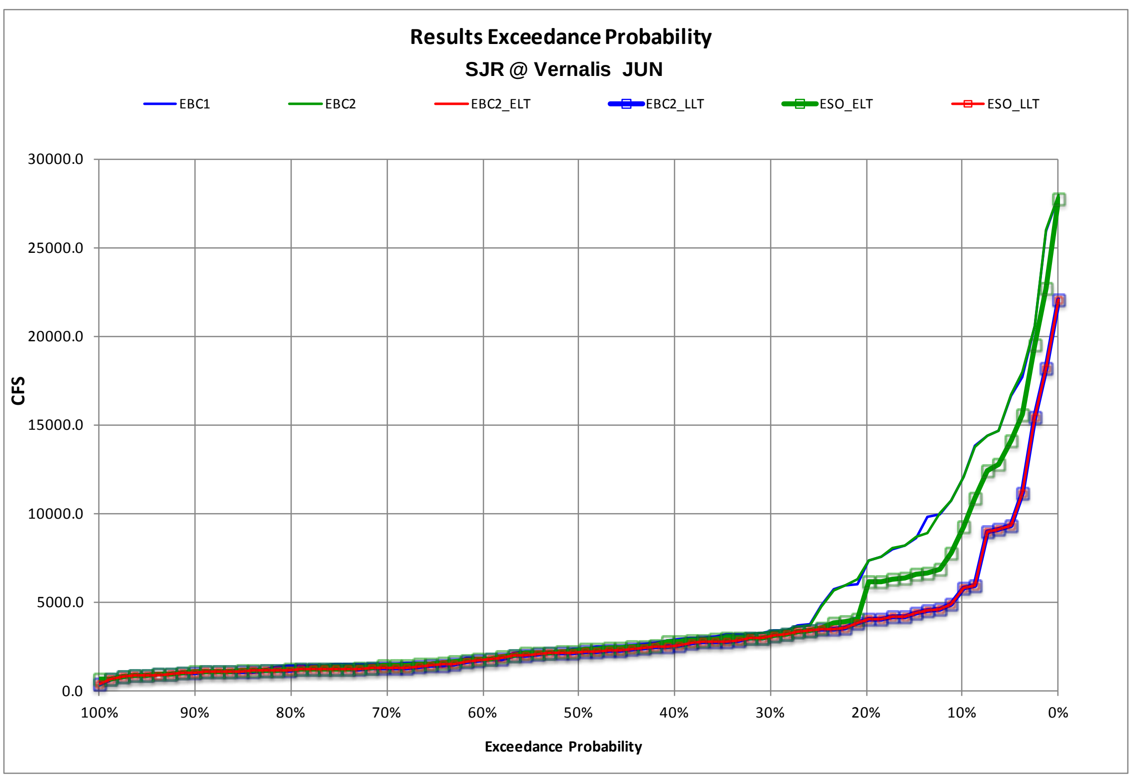

Figure 5C.5.2-174. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the San Joaquin River at Vernalis, June

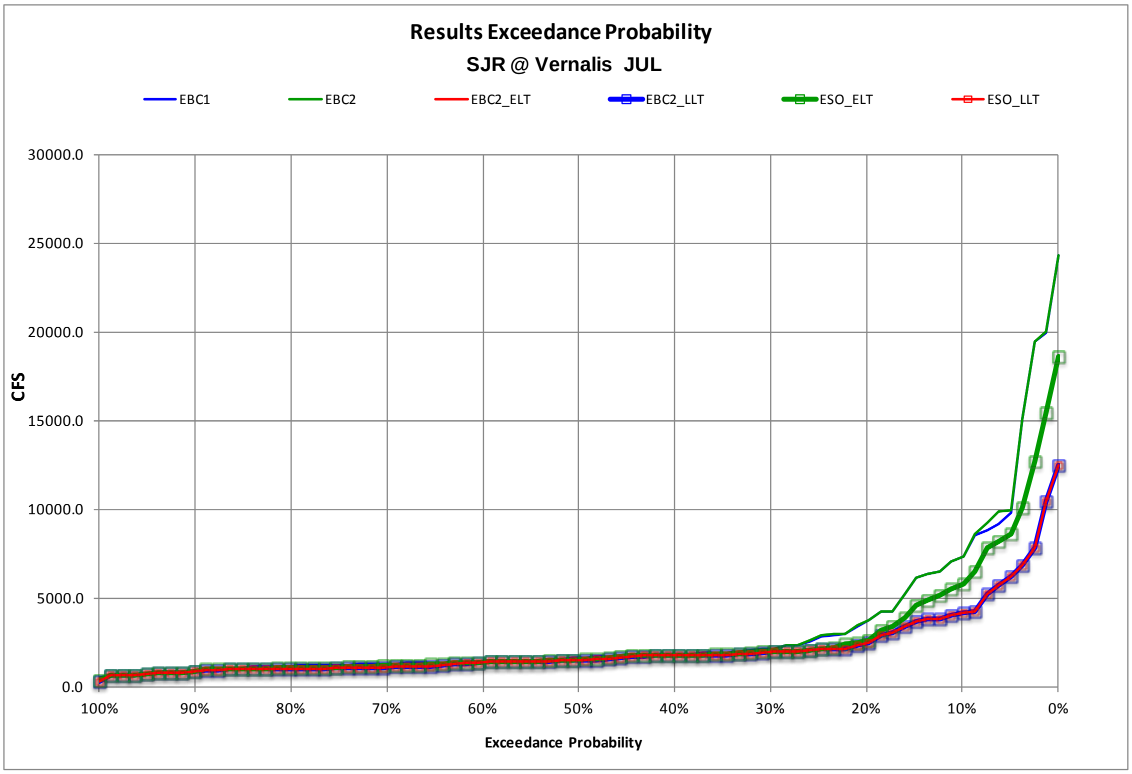

Figure 5C.5.2-175. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the San Joaquin River at Vernalis, July

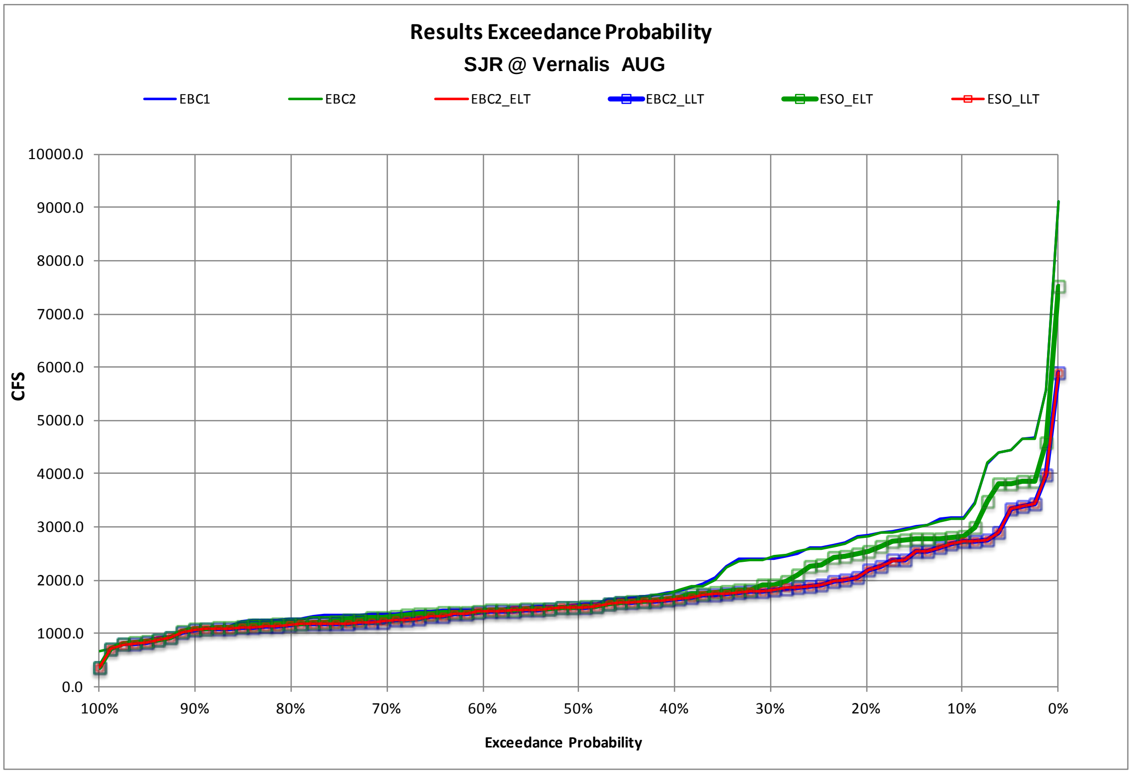

Figure 5C.5.2-176. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the San Joaquin River at Vernalis, August

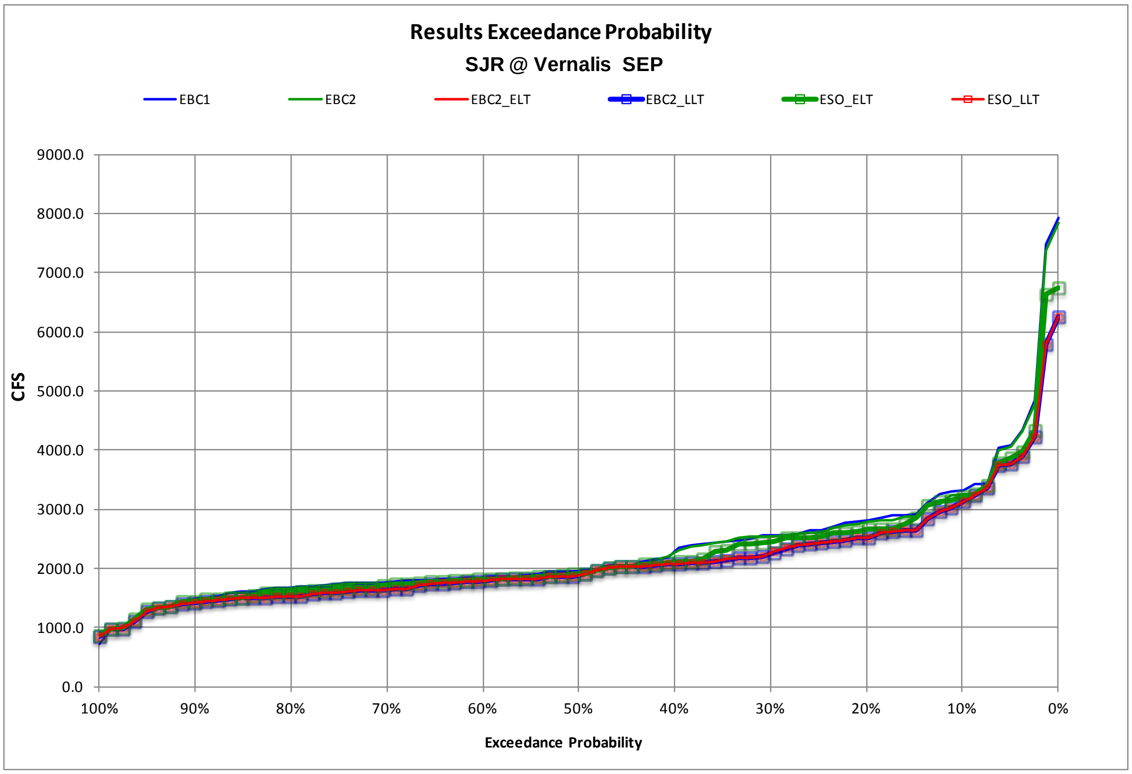

Figure 5C.5.2-177. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the San Joaquin River at Vernalis, September

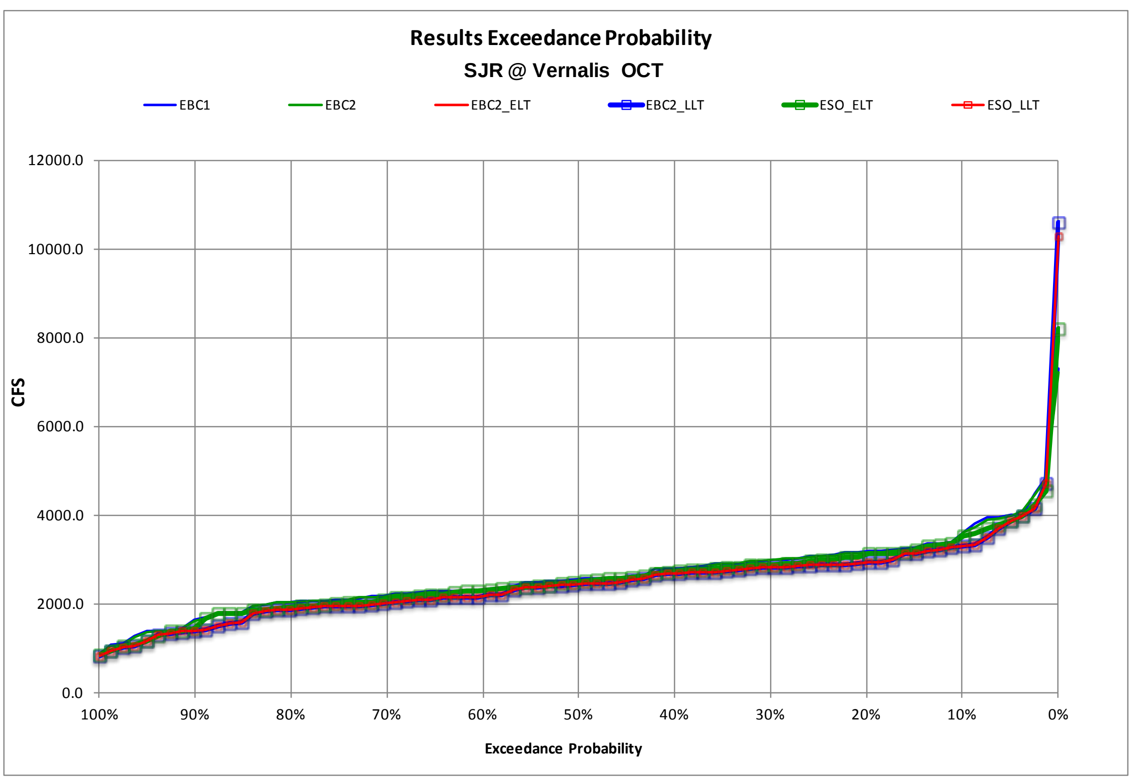

Figure 5C.5.2-178. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the San Joaquin River at Vernalis, October

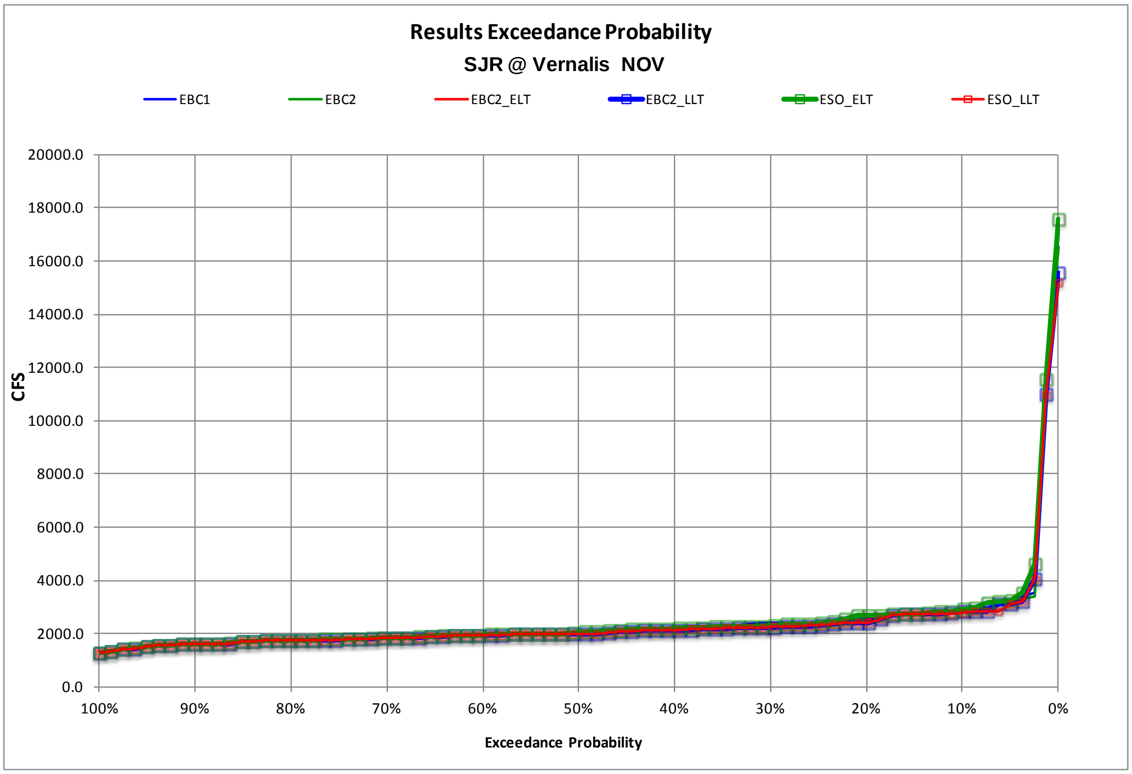

Figure 5C.5.2-179. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the San Joaquin River at Vernalis, November

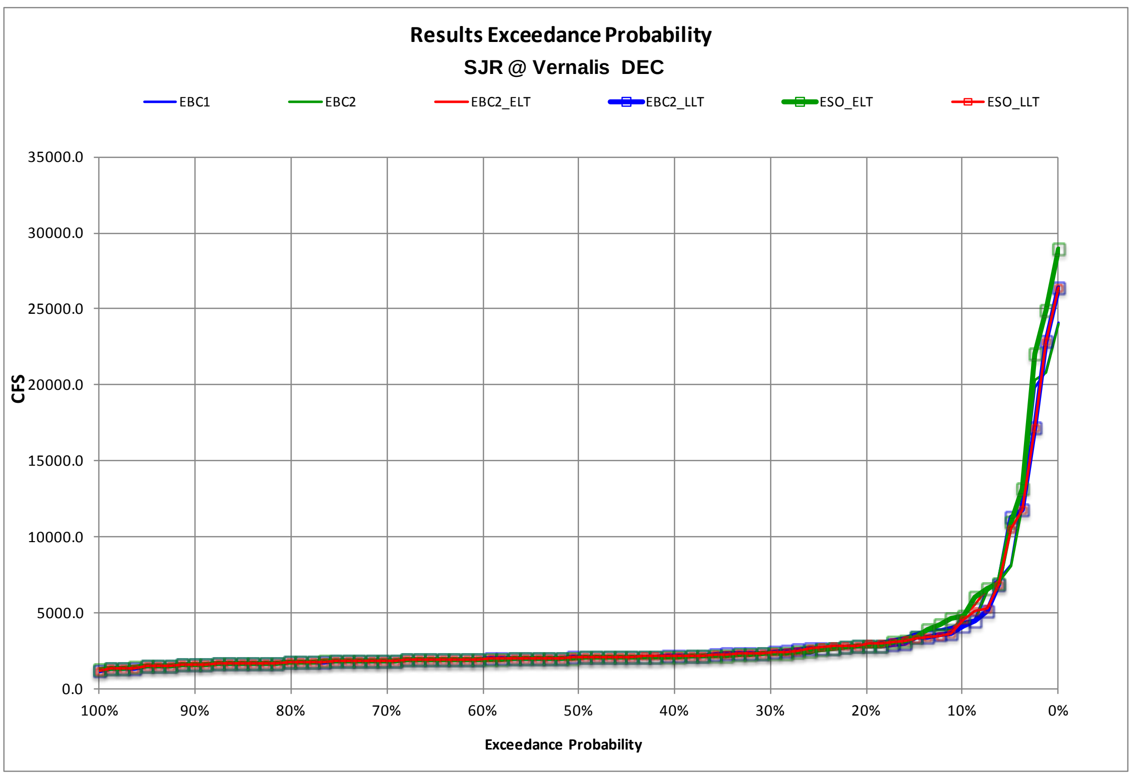

Figure 5C.5.2-180. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the San Joaquin River at Vernalis, December

Table 5C.5.2-257. Mean Monthly Flows (cfs) in the San Joaquin River at Vernalis for ESO, HOS, and LOS Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	9,884	9,675	9,838	9,733	9,874	9,714
	AN	5,809	6,037	5,786	6,058	5,809	5,997
	BN	2,298	2,207	2,310	2,294	2,289	2,195
	D	2,219	2,266	2,219	2,212	2,248	2,222
	C	1,597	1,572	1,599	1,592	1,603	1,592
	All	5,054	5,025	5,038	5,056	5,055	5,024
Feb	W	14,000	13,182	14,001	13,196	13,997	13,178
	AN	7,072	6,701	7,047	6,731	7,039	6,677
	BN	2,933	2,841	2,979	2,803	2,963	2,795
	D	2,312	2,245	2,312	2,245	2,312	2,245
	C	1,942	1,942	1,943	1,942	1,943	1,942
	All	6,688	6,351	6,691	6,355	6,685	6,338
Mar	W	15,129	15,236	15,126	15,242	15,129	15,246
	AN	6,252	6,365	6,252	6,365	6,252	6,365
	BN	2,614	2,476	2,614	2,476	2,614	2,476
	D	2,191	2,146	2,191	2,146	2,192	2,147
	C	1,689	1,688	1,688	1,687	1,689	1,688
	All	6,739	6,763	6,738	6,765	6,739	6,766
Apr	W	12,189	12,460	12,185	12,448	12,190	12,450
	AN	5,970	6,042	5,970	6,043	5,970	6,043
	BN	4,162	3,923	4,161	3,923	4,162	3,924
	D	3,380	3,112	3,379	3,110	3,380	3,113
	C	1,844	1,796	1,843	1,794	1,845	1,796
	All	6,288	6,291	6,286	6,287	6,288	6,289
May	W	13,213	12,633	13,215	12,637	13,212	12,634
	AN	5,279	5,092	5,279	5,093	5,279	5,093
	BN	3,874	3,659	3,873	3,658	3,876	3,661
	D	3,041	2,823	3,039	2,821	3,044	2,825
	C	1,819	1,797	1,817	1,796	1,820	1,799
	All	6,348	6,069	6,348	6,070	6,349	6,071
Jun	W	9,252	6,820	9,256	6,824	9,253	6,822
	AN	2,783	2,679	2,785	2,680	2,784	2,680
	BN	1,964	1,873	1,962	1,871	1,967	1,876
	D	1,362	1,292	1,361	1,290	1,365	1,295
	C	976	956	973	952	977	957
	All	3,969	3,207	3,969	3,207	3,970	3,209
Jul	W	5,904	4,347	5,903	4,347	5,905	4,350
	AN	1,811	1,804	1,810	1,805	1,812	1,806
	BN	1,439	1,386	1,436	1,384	1,445	1,392
	D	1,147	1,101	1,146	1,097	1,151	1,107
	C	870	858	867	854	868	861
	All	2,661	2,186	2,659	2,184	2,663	2,190

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Aug	W	3,052	2,646	3,052	2,646	3,053	2,648
	AN	1,768	1,702	1,767	1,702	1,768	1,703
	BN	1,429	1,378	1,426	1,377	1,433	1,383
	D	1,272	1,226	1,272	1,224	1,276	1,230
	C	993	987	990	984	994	988
	All	1,860	1,712	1,859	1,711	1,862	1,714
Sep	W	3,306	3,128	3,307	3,128	3,307	3,129
	AN	2,223	2,166	2,223	2,166	2,224	2,166
	BN	1,802	1,750	1,801	1,749	1,804	1,752
	D	1,692	1,643	1,691	1,642	1,693	1,645
	C	1,392	1,379	1,391	1,380	1,392	1,380
	All	2,227	2,145	2,227	2,145	2,228	2,146
Oct	W	2,714	2,712	2,709	2,743	2,710	2,682
	AN	2,638	2,595	2,638	2,595	2,638	2,596
	BN	2,412	2,348	2,412	2,348	2,413	2,349
	D	2,849	2,791	2,849	2,791	2,850	2,791
	C	2,163	2,031	2,163	2,031	2,163	2,032
	All	2,565	2,511	2,564	2,520	2,564	2,503
Nov	W	2,516	2,418	2,516	2,404	2,515	2,416
	AN	3,254	3,123	3,240	3,203	3,238	3,170
	BN	2,222	1,997	2,222	1,997	2,222	1,997
	D	2,290	2,253	2,244	2,250	2,290	2,253
	C	1,911	1,898	1,911	1,898	1,911	1,898
	All	2,459	2,361	2,450	2,372	2,456	2,370
Dec	W	4,868	4,492	4,875	4,510	4,862	4,555
	AN	5,001	4,643	4,950	4,582	5,002	4,642
	BN	2,135	2,075	2,100	2,083	2,134	2,083
	D	2,085	2,186	2,086	2,168	2,103	2,168
	C	1,686	1,683	1,684	1,681	1,696	1,681
	All	3,399	3,225	3,385	3,216	3,401	3,241

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-258. Differences[a] between ESO Scenarios and HOS and LOS Scenarios in Mean Monthly Flows (cfs) in the San Joaquin River at Vernalis

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	-46 (-0.5%)	58 (0.6%)	-10 (-0.1%)	39 (0.4%)
	AN	-24 (-0.4%)	21 (0.3%)	-1 (0%)	-40 (-0.7%)
	BN	12 (0.5%)	87 (3.9%)	-9 (-0.4%)	-12 (-0.5%)
	D	0 (0%)	-55 (-2.4%)	30 (1.3%)	-44 (-1.9%)
	C	2 (0.1%)	19 (1.2%)	5 (0.3%)	19 (1.2%)
	All	-16 (-0.3%)	30 (0.6%)	1 (0%)	-1 (0%)
Feb	W	1 (0%)	14 (0.1%)	-3 (0%)	-4 (0%)
	AN	-25 (-0.4%)	30 (0.4%)	-34 (-0.5%)	-24 (-0.4%)
	BN	46 (1.6%)	-38 (-1.3%)	30 (1%)	-46 (-1.6%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	1 (0%)	0 (0%)	1 (0%)	0 (0%)
	All	3 (0%)	4 (0.1%)	-2 (0%)	-13 (-0.2%)
Mar	W	-3 (0%)	7 (0%)	0 (0%)	10 (0.1%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	-1 (0%)	-1 (0%)	0 (0%)	0 (0%)
	All	-1 (0%)	2 (0%)	0 (0%)	3 (0%)
Apr	W	-4 (0%)	-12 (-0.1%)	1 (0%)	-10 (-0.1%)
	AN	0 (0%)	0 (0%)	0 (0%)	1 (0%)
	BN	0 (0%)	0 (0%)	1 (0%)	1 (0%)
	D	-1 (0%)	-1 (0%)	1 (0%)	1 (0%)
	C	-1 (-0.1%)	-2 (-0.1%)	1 (0%)	0 (0%)
	All	-2 (0%)	-4 (-0.1%)	1 (0%)	-2 (0%)
May	W	2 (0%)	3 (0%)	-1 (0%)	0 (0%)
	AN	0 (0%)	1 (0%)	1 (0%)	1 (0%)
	BN	-1 (0%)	-1 (0%)	2 (0.1%)	3 (0.1%)
	D	-1 (0%)	-2 (-0.1%)	3 (0.1%)	2 (0.1%)
	C	-2 (-0.1%)	-1 (-0.1%)	1 (0%)	2 (0.1%)
	All	0 (0%)	0 (0%)	1 (0%)	1 (0%)
Jun	W	4 (0%)	4 (0.1%)	1 (0%)	2 (0%)
	AN	2 (0.1%)	1 (0%)	0 (0%)	1 (0%)
	BN	-2 (-0.1%)	-2 (-0.1%)	3 (0.1%)	3 (0.2%)
	D	-1 (0%)	-2 (-0.1%)	3 (0.2%)	4 (0.3%)
	C	-3 (-0.3%)	-4 (-0.4%)	1 (0.1%)	1 (0.1%)
	All	1 (0%)	0 (0%)	1 (0%)	2 (0.1%)
Jul	W	0 (0%)	-1 (0%)	1 (0%)	2 (0.1%)
	AN	-1 (0%)	1 (0.1%)	1 (0.1%)	1 (0.1%)
	BN	-4 (-0.2%)	-2 (-0.2%)	5 (0.4%)	6 (0.4%)
	D	-1 (-0.1%)	-4 (-0.4%)	5 (0.4%)	6 (0.5%)
	C	-3 (-0.3%)	-5 (-0.5%)	-1 (-0.1%)	3 (0.3%)
	All	-2 (-0.1%)	-2 (-0.1%)	2 (0.1%)	3 (0.2%)

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	0 (0%)	-1 (0%)	1 (0%)	2 (0.1%)
	AN	-1 (0%)	1 (0%)	1 (0%)	1 (0.1%)
	BN	-3 (-0.2%)	-2 (-0.1%)	4 (0.3%)	4 (0.3%)
	D	-1 (-0.1%)	-2 (-0.2%)	3 (0.3%)	4 (0.3%)
	C	-3 (-0.3%)	-4 (-0.4%)	0 (0%)	1 (0.1%)
	All	-1 (-0.1%)	-1 (-0.1%)	2 (0.1%)	2 (0.1%)
Sep	W	1 (0%)	0 (0%)	1 (0%)	1 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	-1 (-0.1%)	-1 (0%)	2 (0.1%)	2 (0.1%)
	D	0 (0%)	-1 (-0.1%)	2 (0.1%)	2 (0.1%)
	C	0 (0%)	1 (0.1%)	0 (0%)	1 (0.1%)
	All	0 (0%)	0 (0%)	1 (0%)	1 (0.1%)
Oct	W	-5 (-0.2%)	31 (1.1%)	-5 (-0.2%)	-31 (-1.1%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	1 (0%)
	All	-2 (-0.1%)	9 (0.4%)	-1 (0%)	-9 (-0.3%)
Nov	W	1 (0%)	-14 (-0.6%)	0 (0%)	-2 (-0.1%)
	AN	-13 (-0.4%)	80 (2.6%)	-16 (-0.5%)	46 (1.5%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	-46 (-2%)	-3 (-0.1%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	-10 (-0.4%)	11 (0.5%)	-3 (-0.1%)	8 (0.4%)
Dec	W	7 (0.1%)	18 (0.4%)	-7 (-0.1%)	63 (1.4%)
	AN	-51 (-1%)	-61 (-1.3%)	0 (0%)	-1 (0%)
	BN	-35 (-1.7%)	8 (0.4%)	-1 (-0.1%)	8 (0.4%)
	D	1 (0%)	-18 (-0.8%)	18 (0.8%)	-18 (-0.8%)
	C	-3 (-0.2%)	-2 (-0.1%)	9 (0.5%)	-2 (-0.1%)
	All	-14 (-0.4%)	-8 (-0.3%)	2 (0.1%)	16 (0.5%)

[a] Negative values indicate lower flows under HOS or LOS than under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

5C.5.2.6.1.3 Adult

Water Temperature

Based on the similarity of San Joaquin River instream flows between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT during the November through April steelhead migration period (Table 5C.5.2-255, Table 5C.5.2-256, Figure 5C.5.2-169 through Figure 5C.5.2-173), it is expected that there would be no differences in seasonal water temperatures between these two pairs of model scenarios that would affect habitat conditions for adult steelhead migrating upstream in the San Joaquin River. Further, there would be no differences in flows between the ESO scenario and HOS and LOS scenarios (Table 5C.5.2-257, Table 5C.5.2-258). As a result, water temperatures are not expected to be different between ESO, HOS, and LOS scenarios that would affect habitat conditions for adult steelhead migrating upstream in the San Joaquin River.

5C.5.2.6.2 Spring-Run

Spring-run Chinook salmon do not currently inhabit the mainstem San Joaquin River or its tributaries, although efforts are currently underway to restore a spring-run population to the upper reaches of the San Joaquin River downstream of Friant Dam. CALSIM results indicate that ESO, HOS, and LOS scenarios would have no flow-related effects on future instream habitat conditions in the San Joaquin River (Table 5C.5.2-255 through Table 5C.5.2-258; Figure 5C.5.2-169 through Figure 5C.5.2-173).

5C.5.2.6.3 Fall-Run/Late Fall–Run

5C.5.2.6.3.1 Eggs and Alevins

Upstream Spawning Habitat

Fall-run Chinook salmon do not currently spawn in the mainstem San Joaquin River. Although efforts are currently underway to restore spring-run and fall-run salmon to the upper reaches of the San Joaquin River downstream of Friant Dam, the ESO would have no flow-related effects on future instream habitat conditions in the San Joaquin River regardless of month or water-year type (Table 5C.5.2-255, Table 5C.5.2-256, Figure 5C.5.2-169 through Figure 5C.5.2-173). Further, there would be no differences in flows between the ESO scenario and HOS and LOS scenarios (Table 5C.5.2-257, Table 5C.5.2-258).

5C.5.2.6.3.2 Fry and Juvenile Rearing

Rearing Habitat

Fall-run Chinook salmon juveniles rear in the lower San Joaquin River. During the late winter and early spring, fall-run salmon fry may rear in the river prior to migrating downstream to coastal marine waters, although the majority of juvenile fall-run salmon are expected to migrate downstream as smolts later in the spring (April through May). The ESO, HOS, and LOS scenarios would have no flow-related effects on future instream habitat conditions in the San Joaquin River regardless of month or water-year type (Table 5C.5.2-255 through Table 5C.5.2-258, Figure 5C.5.2-169 through Figure 5C.5.2-173). Other drivers, notably climate change, are predicted to have the greatest effect on future flows and water temperatures. Based on these results, it was concluded that ESO, HOS, and LOS would not affect instream habitat conditions in the lower San Joaquin River for fall-run fry or juvenile rearing.

5C.5.2.6.3.3 Adult

Water Temperature

Based on the similarity of San Joaquin River instream flows between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT (Table 5C.5.2-255, Table 5C.5.2-256, Figure 5C.5.2-169 through Figure 5C.5.2-173, it is expected that there would be no differences in seasonal water temperatures between these two pairs of model scenarios that would affect habitat conditions for adult fall-run Chinook salmon migrating upstream in the San Joaquin River. Further, there would be no differences in flows between the ESO scenario and HOS and LOS scenarios (Table 5C.5.2-257, Table 5C.5.2-258). As a result, water temperatures are not expected to be different between ESO, HOS, and LOS scenarios that would affect habitat conditions for adult fall-run migrating upstream in the San Joaquin River.

5C.5.2.6.4 Splittail

Splittail spawning and rearing of larvae and young juveniles in channel margin and side-channel habitat upstream of the Delta is likely to be especially important during dry years, when flows are too low to inundate the floodplains. Splittail have been found in the San Joaquin River as far upstream as the confluence with the Tuolumne River (Sommer et al. 2007).

Rearing Habitat

The upstream side-channel habitats used by splittail for spawning and rearing are, as previously indicated, affected by changes in flow because greater flows cause more flooding, thereby increasing availability of such habitat, and because rapid reductions in flow dewater the habitats, potentially stranding splittail eggs and rearing larvae. The changes in flows are expected to be especially important in years with low-flows. Simulated flows in the San Joaquin River at Vernalis were used to investigate the potential effects of BDCP operations on side-channel habitat availability on the mainstem of the river. This analysis was limited to flows during February through June because these are the most important months for splittail spawning and larval and juvenile rearing and the months in which splittail are most likely to be upstream in the San Joaquin River. The ESO, HOS, and LOS scenarios would not affect flow conditions in the San Joaquin River during these months regardless of water-year type (Table 5C.5.2-255 through Table 5C.5.2-258, Figure 5C.5.2-170 through Figure 5C.5.2-174).

Water Temperature

Based on the similarity of San Joaquin River instream flows between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT (Table 5C.5.2-255, Table 5C.5.2-256, Figure 5C.5.2-169 through Figure 5C.5.2-173, there would be no differences in seasonal water temperatures between these two pairs of model scenarios that would affect habitat conditions for splittail in the San Joaquin River. Further, there would be no differences in flows between the ESO scenario and HOS and LOS scenarios (Table 5C.5.2-257, Table 5C.5.2-258). As a result, water temperatures are not expected to be different between ESO, HOS, and LOS scenarios that would affect habitat conditions for splittail habitat conditions in the San Joaquin River.

5C.5.2.6.5 White Sturgeon

Due to uncertainties regarding white sturgeon presence in the San Joaquin River system, the analysis of effects on white sturgeon in the Stanislaus River was combined with the analysis in the mainstem San Joaquin River here.

5C.5.2.6.5.1 Egg/Embryo

A review of the CDFW sturgeon recreational fishery tag data from 2007 through 2009 did not indicate that white sturgeon immigrate into the Stanislaus River during the winter or spring to spawn. This suggests that the Stanislaus River downstream of Goodwin Dam does not provide spawning or egg incubation habitats for white sturgeon. Based on CDFW recreational fishery tag data, white sturgeon are observed in the mainstem San Joaquin River upstream of the confluence with the Merced River during the winter and spring, so it is assumed white sturgeon are spawning somewhere within the San Joaquin River.

CALSIM hydrologic modeling over the 82-year simulation period for the lower San Joaquin River at Vernalis predicts no difference in instream flows (<5%) between EBC2_ELT and ESO_ELT, EBC2_LLT and ESO_LLT, and the ESO scenario and HOS and LOS scenarios during the primary spawning and egg incubation period for white sturgeon (February through May) (Table 5C.5.2-255 through Table 5C.5.2-258, Figure 5C.5.2-170 through Figure 5C.5.2-173). Other drivers, notably climate change, are predicted to have the greatest effect on future flows and water temperatures. Based on these results, it was concluded that ESO, HOS, and LOS scenarios would not affect instream habitat conditions for white sturgeon in the lower San Joaquin River.

5C.5.2.6.5.2 Larvae

Water Temperature

Based on the similarity of San Joaquin River instream flows during the February through June larval white sturgeon rearing period between EBC2_ELT and ESO_ELT, EBC2_LLT and ESO_LLT, and the ESO scenario and HOS and LOS scenarios (Table 5C.5.2-255through Table 5C.5.2-258, Figure 5C.5.2-169 through Figure 5C.5.2-173), there would be no differences in mean monthly water temperatures EBC2 scenarios and ESO, HOS, and LOS scenarios that would affect habitat conditions for white sturgeon larvae in the San Joaquin River.

Mean monthly water temperatures in the Stanislaus River at its confluence with the San Joaquin River are presented in Table 5C.5.2-259 and differences between pairs of model scenarios are presented in Table 5C.5.2-260. Results indicate that mean monthly water temperatures under ESO_ELT and ESO_LLT would be similar to mean monthly temperatures under EBC2_ELT and EBC2_LLT, respectively, during the February through June larval rearing period regardless of month and water-year type. Further, mean monthly water temperatures under HOS and LOS scenarios would not differ from those under ESO during the February through June period (Table 5C.5.2-261, Table 5C.5.2-262). Therefore, no further water temperature-related biological analyses on larval white sturgeon rearing are reported.

Table 5C.5.2-259. Mean Monthly Water Temperature (°F) in the Stanislaus River at the Confluence with the San Joaquin River under EBC and ESO Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	46	46	48	49	48	49
	AN	46	46	47	49	47	49
	BN	46	46	47	49	47	49
	D	45	45	46	47	46	47
	C	45	45	46	48	46	48
	All	46	46	47	48	47	48
Feb	W	50	50	51	53	51	53
	AN	50	50	52	53	52	53
	BN	50	50	51	52	51	52
	D	50	50	52	53	52	53
	C	51	51	53	54	53	54
	All	50	50	52	53	52	53
Mar	W	52	52	53	55	53	55
	AN	53	53	54	56	54	56
	BN	54	54	55	57	55	57
	D	55	55	57	58	57	58
	C	55	55	56	58	56	58
	All	54	54	55	56	55	56
Apr	W	54	54	55	57	55	57
	AN	55	55	57	58	57	58
	BN	56	56	58	60	58	60
	D	57	57	58	60	58	60
	C	59	59	60	62	60	62
	All	56	56	57	59	57	59
May	W	59	59	60	62	60	62
	AN	60	60	62	63	62	63
	BN	60	60	63	64	63	64
	D	61	62	64	65	64	65
	C	63	63	65	66	65	66
	All	60	61	62	64	62	64
Jun	W	62	62	64	65	64	65
	AN	65	65	67	69	67	69
	BN	66	66	68	70	68	70
	D	68	69	70	72	70	72
	C	68	68	70	71	70	71
	All	65	66	67	69	67	69
Jul	W	68	67	69	70	69	70
	AN	70	70	72	73	72	73
	BN	70	70	71	73	71	73
	D	70	71	72	74	72	74
	C	70	70	72	73	72	73
	All	69	69	71	72	71	72

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Aug	W	67	67	69	71	69	71
	AN	69	69	70	72	70	72
	BN	68	68	70	71	70	71
	D	69	69	71	72	71	72
	C	69	69	70	72	70	72
	All	68	68	70	72	70	72
Sep	W	65	65	67	69	67	69
	AN	67	67	69	71	69	71
	BN	67	67	68	70	68	70
	D	67	67	69	70	69	70
	C	67	67	68	70	68	70
	All	66	66	68	70	68	70
Oct	W	60	60	61	63	61	63
	AN	60	60	61	62	61	62
	BN	59	59	60	62	60	62
	D	59	59	61	62	61	62
	C	61	61	62	64	62	64
	All	60	60	61	63	61	63
Nov	W	53	53	54	56	54	56
	AN	52	52	53	55	53	55
	BN	52	52	53	55	53	55
	D	52	52	53	55	53	55
	C	53	53	54	56	54	56
	All	52	52	54	55	54	55
Dec	W	47	47	48	50	48	50
	AN	46	46	48	49	48	49
	BN	45	45	47	49	47	49
	D	45	45	46	48	46	48
	C	45	45	46	48	46	48
	All	46	46	47	49	47	49

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-260. Differences[a] between EBC and ESO Scenarios in Water Temperature (°F) in the Stanislaus River at the Confluence with the San Joaquin River, by Water-Year Type

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	1 (2.9%)	3 (6.3%)	1 (2.9%)	3 (6.3%)	0 (0%)	0 (0%)
	AN	1 (3%)	3 (6.4%)	1 (3%)	3 (6.4%)	0 (0%)	0 (0%)
	BN	1 (2.9%)	3 (6.1%)	1 (2.9%)	3 (6.1%)	0 (0%)	0 (0%)
	D	1 (2.7%)	3 (5.7%)	1 (2.7%)	3 (5.7%)	0 (0%)	0 (0%)
	C	1 (2.9%)	3 (6.1%)	1 (3.2%)	3 (6.4%)	0 (0%)	0 (0%)
	All	1 (2.9%)	3 (6.2%)	1 (3%)	3 (6.2%)	0 (0%)	0 (0%)
Feb	W	1 (2.4%)	3 (5.7%)	1 (2.5%)	3 (5.7%)	0 (0%)	0 (0%)
	AN	1 (2.8%)	3 (5.6%)	1 (2.8%)	3 (5.6%)	0 (0%)	0 (0%)
	BN	2 (3.1%)	3 (5.2%)	1 (2.9%)	3 (5%)	0 (0%)	0 (0%)
	D	2 (3.1%)	3 (5.6%)	1 (3%)	3 (5.5%)	0 (0%)	0 (0%)
	C	2 (3%)	3 (5.6%)	1 (2.7%)	3 (5.3%)	0 (0%)	0 (0%)
	All	1 (2.8%)	3 (5.6%)	1 (2.7%)	3 (5.5%)	0 (0%)	0 (0%)
Mar	W	1 (1.9%)	3 (5.5%)	1 (1.9%)	3 (5.5%)	0 (0%)	0 (0%)
	AN	2 (3%)	3 (6.3%)	2 (3%)	3 (6.3%)	0 (0%)	0 (0%)
	BN	1 (2.2%)	3 (4.9%)	1.2 (2.2%)	3 (4.9%)	0 (0%)	0 (0%)
	D	1.6 (2.9%)	3 (5.8%)	1 (2.7%)	3 (5.6%)	0 (0%)	0 (0%)
	C	1 (2.3%)	3 (5.1%)	1 (1.8%)	3 (4.6%)	0 (0%)	0 (0%)
	All	1 (2.4%)	3 (5.5%)	1 (2.3%)	3 (5.4%)	0 (0%)	0 (0%)
Apr	W	1 (2.4%)	3 (5.2%)	1 (2.4%)	3 (5.2%)	0 (0%)	0 (0%)
	AN	1 (2.7%)	3 (5.6%)	1 (2.6%)	3 (5.6%)	0 (0%)	0 (0%)
	BN	2 (3.1%)	3 (6.1%)	2 (3.1%)	3 (6.1%)	0 (0%)	0 (0%)
	D	2 (2.9%)	3 (6.1%)	2 (2.7%)	3 (5.9%)	0 (0%)	0 (0%)
	C	2 (2.6%)	3 (5.5%)	1 (2.4%)	3 (5.3%)	0 (0%)	0 (0%)
	All	2 (2.7%)	3 (5.6%)	1 (2.6%)	3 (5.6%)	0 (0%)	0 (0%)
May	W	2 (2.8%)	3 (5.3%)	2 (2.9%)	3 (5.4%)	0 (0%)	0 (0%)
	AN	2 (3.3%)	3 (5.7%)	2 (3.2%)	3 (5.7%)	0 (0%)	0 (0%)
	BN	2 (3.8%)	4 (6.8%)	2 (3.8%)	4 (6.7%)	0 (0%)	0 (0%)
	D	2 (3.4%)	4 (6%)	2 (3.1%)	4 (5.7%)	0 (0%)	0 (0%)
	C	2 (3%)	3 (5.1%)	2 (2.8%)	3 (4.9%)	0 (0%)	0 (0%)
	All	2 (3.2%)	3 (5.7%)	2 (3.1%)	3 (5.6%)	0 (0%)	0 (0%)
Jun	W	1 (1.9%)	2 (3.6%)	1 (2%)	2 (3.7%)	0 (0%)	0 (0%)
	AN	2 (2.8%)	4 (5.8%)	2 (2.9%)	4 (5.8%)	0 (0%)	0 (0%)
	BN	2 (2.7%)	3 (5.1%)	2 (2.7%)	3 (5%)	0 (0%)	0 (0%)
	D	1.9 (2.8%)	3 (5%)	1.7 (2.5%)	3 (4.7%)	0 (0%)	0 (0%)
	C	2 (2.7%)	3 (4.7%)	2 (2.5%)	3 (4.6%)	0 (0%)	0 (0%)
	All	2 (2.5%)	3 (4.7%)	2 (2.5%)	3 (4.7%)	0 (0%)	0 (0%)
Jul	W	1 (2.1%)	2 (3.3%)	2 (2.5%)	2 (3.7%)	0 (0%)	0 (0%)
	AN	1.8 (2.5%)	3 (4.2%)	1.7 (2.5%)	3 (4.2%)	0 (0%)	0 (0%)
	BN	2 (2.3%)	3 (4%)	2 (2.2%)	3 (3.9%)	0 (0%)	0 (0%)
	D	2 (2.6%)	3 (4.5%)	2 (2.1%)	3 (4.1%)	0 (0%)	0 (0%)
	C	2 (2.5%)	3 (4.5%)	2 (2.5%)	3 (4.4%)	0 (0%)	0 (0%)
	All	2 (2.4%)	3 (4%)	2 (2.4%)	3 (4%)	0 (0%)	0 (0%)

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Aug	W	1.9 (2.8%)	4 (6.1%)	2 (2.8%)	4 (6.1%)	0 (0%)	0 (0%)
	AN	1.7 (2.4%)	3 (4.7%)	1.7 (2.4%)	3 (4.7%)	0 (0%)	0 (0%)
	BN	2 (2.3%)	3 (4.5%)	2 (2.3%)	3 (4.5%)	0 (0%)	0 (0%)
	D	2 (2.3%)	3 (4.5%)	2 (2.3%)	3 (4.5%)	0 (0%)	0 (0%)
	C	2 (2.8%)	4 (5.2%)	2 (2.5%)	3 (4.9%)	0 (0%)	0 (0%)
	All	2 (2.6%)	4 (5.1%)	2 (2.5%)	3 (5.1%)	0 (0%)	0 (0%)
Sep	W	2 (2.7%)	4 (6%)	2 (2.6%)	4 (6%)	0 (0%)	0 (0%)
	AN	2 (2.7%)	4 (5.6%)	2 (2.7%)	4 (5.6%)	0 (0%)	0 (0%)
	BN	2 (2.6%)	4 (5.5%)	2 (2.6%)	4 (5.5%)	0 (0%)	0 (0%)
	D	2 (2.6%)	4 (5.5%)	2 (2.6%)	4 (5.5%)	0 (0%)	0 (0%)
	C	2 (2.7%)	4 (5.3%)	2 (2.8%)	4 (5.4%)	0 (0%)	-0.2 (-0.2%)
	All	2 (2.7%)	4 (5.6%)	2 (2.7%)	4 (5.6%)	0 (0%)	0 (0%)
Oct	W	1 (2.2%)	3 (5%)	1 (2.2%)	3 (5%)	0 (0%)	0 (0%)
	AN	1 (2%)	3 (4.8%)	1.2 (2%)	3 (4.8%)	0 (0%)	0 (0%)
	BN	1 (1.8%)	3 (4.5%)	1 (1.8%)	3 (4.5%)	0 (0%)	0 (0%)
	D	1 (2.1%)	3 (4.9%)	1 (2.1%)	3 (4.9%)	0 (0%)	0 (0%)
	C	1 (2.4%)	3 (5.3%)	2 (2.5%)	3 (5.4%)	0 (0%)	0 (0%)
	All	1 (2.1%)	3 (4.9%)	1 (2.2%)	3 (4.9%)	0 (0%)	0 (0%)
Nov	W	1 (2.3%)	3 (5.8%)	1 (2.3%)	3 (5.8%)	0 (0%)	0 (0%)
	AN	1 (2.3%)	3 (6%)	1 (2.3%)	3 (6.1%)	0 (0%)	0 (0%)
	BN	1 (2.3%)	3 (5.9%)	1 (2.3%)	3 (6%)	0 (0%)	0 (0%)
	D	1 (2.2%)	3 (5.9%)	1 (2.2%)	3 (5.9%)	0 (0%)	0 (0%)
	C	1 (2.2%)	3 (5.6%)	1 (2.2%)	3 (5.6%)	0 (0%)	0 (0%)
	All	1 (2.3%)	3 (5.8%)	1 (2.3%)	3 (5.8%)	0 (0%)	0 (0%)
Dec	W	1 (2.7%)	3 (6.6%)	1 (2.7%)	3 (6.7%)	0 (0%)	0.03 (0.1%)
	AN	1 (2.5%)	3 (6.2%)	1 (2.5%)	3 (6.2%)	0 (0%)	0 (0%)
	BN	1 (2.7%)	3 (7.1%)	1 (2.6%)	3 (7.1%)	0 (0%)	0 (0%)
	D	1 (2.2%)	3 (6.1%)	1 (2.2%)	3 (6.1%)	0 (0%)	0 (0%)
	C	1 (2.4%)	3 (6.4%)	1 (2.4%)	3 (6.4%)	0 (0%)	0 (0%)
	All	1 (2.5%)	3 (6.5%)	1 (2.5%)	3 (6.5%)	0 (0%)	0 (0%)

[a] Positive values indicate higher water temperature under ESO than under EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-261. Mean Monthly Water Temperature (°F) in the Stanislaus River at the Confluence with the San Joaquin River for ESO, HOS, and LOS Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	48	49	48	49	48	49
	AN	47	49	47	49	47	49
	BN	47	49	47	49	47	49
	D	46	47	46	47	46	47
	C	46	48	46	48	46	48
	All	47	48	47	48	47	48
Feb	W	51	53	51	53	51	53
	AN	52	53	52	53	52	53
	BN	51	52	51	52	51	52
	D	52	53	52	53	52	53
	C	53	54	53	54	53	54
	All	52	53	52	53	52	53
Mar	W	53	55	53	55	53	55
	AN	54	56	54	56	54	56
	BN	55	57	55	57	55	57
	D	57	58	57	58	57	58
	C	56	58	56	58	56	58
	All	55	56	55	56	55	56
Apr	W	55	57	55	57	55	57
	AN	57	58	57	58	57	58
	BN	58	60	58	60	58	60
	D	58	60	58	60	58	60
	C	60	62	60	62	60	62
	All	57	59	57	59	57	59
May	W	60	62	60	62	60	62
	AN	62	63	62	63	62	63
	BN	63	64	63	64	63	64
	D	64	65	64	65	64	65
	C	65	66	65	66	65	66
	All	62	64	62	64	62	64
Jun	W	64	65	64	65	64	65
	AN	67	69	67	69	67	69
	BN	68	70	68	70	68	70
	D	70	72	70	72	70	72
	C	70	71	70	71	70	71
	All	67	69	67	69	67	69
Jul	W	69	70	69	70	69	70
	AN	72	73	72	73	72	73
	BN	71	73	71	73	71	73
	D	72	74	72	74	72	74
	C	72	73	72	73	72	73
	All	71	72	71	72	71	72

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Aug	W	69	71	69	71	69	71
	AN	70	72	70	72	70	72
	BN	70	71	70	71	70	71
	D	71	72	71	72	71	72
	C	70	72	70	72	70	72
	All	70	72	70	72	70	72
Sep	W	67	69	67	69	67	69
	AN	69	71	69	71	69	71
	BN	68	70	68	70	68	70
	D	69	70	69	70	69	70
	C	68	70	68	70	68	70
	All	68	70	68	70	68	70
Oct	W	61	63	61	63	61	63
	AN	61	62	61	62	61	62
	BN	60	62	60	62	60	62
	D	61	62	61	62	61	62
	C	62	64	62	64	62	64
	All	61	63	61	63	61	63
Nov	W	54	56	54	56	54	56
	AN	53	55	53	55	53	55
	BN	53	55	53	55	53	55
	D	53	55	53	55	53	55
	C	54	56	54	56	54	56
	All	54	55	54	55	54	55
Dec	W	48	50	48	50	48	50
	AN	48	49	48	49	48	49
	BN	47	49	47	49	47	49
	D	46	48	46	48	46	48
	C	46	48	46	48	46	48
	All	47	49	47	49	47	49

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

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Table 5C.5.2-262. Differences[a] between the ESO Scenarios and HOS and LOS Scenarios in Mean Monthly Water Temperature (°F) in the Stanislaus River at the Confluence with the Sacramento River

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0.1 (0.1%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0.1 (0.1%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	-0.3 (-0.4%)	0 (0%)	0 (0%)	0 (0%)
	All	-0.1 (-0.1%)	0 (0%)	0 (0%)	0 (0%)
Sep	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	-0.2 (-0.3%)	0 (0%)	0 (0%)	0 (0%)
	All	-0.04 (-0.1%)	0 (0%)	0 (0%)	0 (0%)
Oct	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	W	0 (0%)	-0.1 (-0.2%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	-0.03 (-0.1%)	0 (0%)	0 (0%)

[a] Negative values indicate lower water temperature under HOS or LOS than under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

5C.5.2.6.5.3 Juvenile

Water Temperature

Mean monthly water temperatures in the Stanislaus River at its confluence with the San Joaquin River are presented in Table 5C.5.2-259 and differences between pairs of model scenarios are presented in Table 5C.5.2-260. Results indicate that mean monthly water temperatures under ESO_ELT and ESO_LLT would be similar to mean monthly temperatures under EBC2_ELT and EBC2_LLT during the year-round juvenile rearing period regardless of month and water-year type. Further, mean monthly water temperatures under HOS and LOS scenarios would not differ from those under ESO throughout the year (Table 5C.5.2-261, Table 5C.5.2-262). Therefore, no further water temperature-related biological analyses on juvenile white sturgeon rearing are reported.

5C.5.2.7 Stanislaus River

5C.5.2.7.1 Steelhead

5C.5.2.7.1.1 Eggs and Alevins

Upstream Spawning Habitat

The two primary potential effects of BDCP operations on habitat conditions for steelhead spawning and egg incubation on the Stanislaus River relate to changes in instream flows or seasonal water temperatures released from New Melones Reservoir. The primary spawning and incubation period extends from January through April. Results of these instream flow summaries are presented in Table 5C.5.2-263 and differences between pairs of model scenarios are presented in Table 5C.5.2-260. Monthly frequency of exceedance plots for Stanislaus River flows for all months are presented in Figure 5C.5.2-181 through Figure 5C.5.2-192, and during the steelhead spawning and egg incubation period in Figure 5C.5.2-181 through Figure 5C.5.2-184. These results indicate that instream flows would be nearly identical between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT for all months and water-year types. Flows under HOS and LOS scenarios would generally be similar to flows under ESO during the primary steelhead spawning and egg incubation period (Table 5C.5.2-265, Table 5C.5.2-266. Overall, these results indicate that there would be no effects of ESO, HOS, and LOS scenarios on flows in the Stanislaus River during the January through April primary steelhead spawning and egg incubation period.

Table 5C.5.2-263. Mean Monthly Flows (cfs) in the Stanislaus River at the Confluence with the San Joaquin River under EBC and ESO Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	956	945	968	885	968	885
	AN	843	833	911	963	912	963
	BN	416	403	382	369	382	369
	D	403	403	393	366	393	366
	C	314	296	278	265	278	265
	AVG	635	624	638	615	638	615
Feb	W	1,285	1,271	1,500	1,236	1,500	1,227
	AN	917	887	985	858	985	858
	BN	551	527	522	438	522	437
	D	562	504	411	359	410	359
	C	490	364	349	348	349	348
	AVG	827	780	847	723	847	721
Mar	W	2,063	2,055	2,259	2,217	2,259	2,217
	AN	1,295	1,299	1,108	956	1,108	956
	BN	732	718	642	548	642	548
	D	559	533	431	390	431	390
	C	541	445	445	444	445	444
	AVG	1,167	1,140	1,134	1,071	1,134	1,071

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Apr	W	2,054	2,063	2,047	1,965	2,047	1,965
	AN	1,719	1,719	1,605	1,535	1,605	1,535
	BN	1,494	1,470	1,344	1,211	1,344	1,211
	D	1,438	1,415	1,320	1,199	1,320	1,199
	C	823	791	720	670	720	669
	AVG	1,562	1,551	1,475	1,387	1,475	1,387
May	W	1,653	1,675	1,688	1,613	1,688	1,614
	AN	1,389	1,395	1,292	1,243	1,294	1,243
	BN	1,238	1,227	1,094	898	1,093	898
	D	1,140	1,105	1,039	916	1,039	916
	C	715	672	648	627	648	626
	AVG	1,271	1,263	1,211	1,125	1,211	1,125
Jun	W	1,608	1,618	1,786	1,763	1,785	1,761
	AN	1,134	1,142	1,087	985	1,085	984
	BN	663	654	609	568	607	567
	D	447	418	383	364	385	364
	C	332	307	308	296	308	292
	AVG	932	926	952	914	952	912
Jul	W	1,064	1,120	1,070	1,080	1,069	1,080
	AN	489	484	456	454	456	454
	BN	450	430	427	425	427	425
	D	398	345	355	359	355	360
	C	337	329	318	310	318	311
	AVG	607	610	588	590	588	590
Aug	W	930	937	843	717	843	717
	AN	476	476	455	454	455	454
	BN	423	423	422	418	422	418
	D	387	387	384	382	384	382
	C	341	360	341	338	341	339
	AVG	560	566	530	491	530	492
Sep	W	1,040	1,028	965	863	965	863
	AN	502	503	477	474	477	474
	BN	417	417	413	407	413	407
	D	395	396	392	390	392	390
	C	324	340	327	317	327	330
	AVG	595	594	567	533	567	536
Oct	W	897	908	869	845	869	846
	AN	873	872	844	822	844	825
	BN	903	903	851	844	851	844
	D	984	984	980	925	980	925
	C	689	687	670	612	670	614
	AVG	867	869	840	808	840	809

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Nov	W	426	424	427	408	427	408
	AN	580	574	591	524	591	524
	BN	341	341	341	334	341	334
	D	345	345	337	321	337	321
	C	325	326	311	308	311	308
	AVG	410	409	409	386	409	386
Dec	W	512	530	526	429	526	441
	AN	722	711	767	697	767	697
	BN	331	331	331	353	331	353
	D	317	317	310	294	310	294
	C	289	290	275	272	275	272
	AVG	450	453	459	417	459	421

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-264. Differences[a] between EBC and ESO Scenarios in Mean Monthly Flows (cfs) in the Stanislaus River at the Confluence with the San Joaquin River

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	12 (1.2%)	-71 (-7.4%)	23 (2.4%)	-60 (-6.3%)	0 (0%)	0 (0%)
	AN	70 (8.3%)	120 (14.3%)	79 (9.5%)	130 (15.6%)	1 (0.1%)	0 (0%)
	BN	-34 (-8.2%)	-47 (-11.3%)	-21 (-5.2%)	-34 (-8.4%)	0 (0%)	0 (0%)
	D	-10 (-2.4%)	-37 (-9.1%)	-10 (-2.4%)	-37 (-9.1%)	0 (0%)	0 (0%)
	C	-36 (-11.5%)	-49 (-15.6%)	-18 (-6.1%)	-31 (-10.4%)	0 (0%)	0 (0%)
	All	3 (0.5%)	-20 (-3.2%)	14 (2.2%)	-9 (-1.5%)	0 (0%)	0 (0%)
Feb	W	215 (16.8%)	-58 (-4.5%)	229 (18%)	-44 (-3.5%)	0 (0%)	-9 (-0.7%)
	AN	68 (7.4%)	-59 (-6.4%)	98 (11.1%)	-29 (-3.3%)	0 (0%)	0 (0%)
	BN	-30 (-5.4%)	-114 (-20.7%)	-6 (-1.1%)	-90 (-17.1%)	0 (0%)	-1 (-0.2%)
	D	-152 (-27%)	-203 (-36.1%)	-93 (-18.5%)	-145 (-28.8%)	0 (0%)	0 (0%)
	C	-141 (-28.8%)	-142 (-29%)	-15 (-4.2%)	-16 (-4.5%)	0 (0%)	0 (0%)
	All	20 (2.4%)	-106 (-12.9%)	68 (8.7%)	-59 (-7.6%)	0 (0%)	-3 (-0.4%)
Mar	W	196 (9.5%)	154 (7.4%)	205 (10%)	162 (7.9%)	0 (0%)	0 (0%)
	AN	-187 (-14.4%)	-339 (-26.2%)	-190 (-14.7%)	-342 (-26.4%)	0 (0%)	0 (0%)
	BN	-90 (-12.4%)	-185 (-25.2%)	-76 (-10.6%)	-170 (-23.7%)	0 (0%)	0 (0%)
	D	-127 (-22.8%)	-168 (-30.1%)	-102 (-19.1%)	-143 (-26.8%)	0 (0%)	0 (0%)
	C	-96 (-17.7%)	-97 (-17.9%)	-0.5 (-0.1%)	-2 (-0.4%)	0 (0%)	0 (0%)
	All	-32 (-2.8%)	-96 (-8.2%)	-6 (-0.5%)	-69 (-6.1%)	0 (0%)	0 (0%)
Apr	W	-7 (-0.3%)	-89 (-4.3%)	-16 (-0.8%)	-98 (-4.7%)	0 (0%)	0 (0%)
	AN	-114 (-6.6%)	-184 (-10.7%)	-114 (-6.6%)	-184 (-10.7%)	0 (0%)	0 (0%)
	BN	-149 (-10%)	-283 (-18.9%)	-126 (-8.6%)	-260 (-17.7%)	0 (0%)	0 (0%)
	D	-118 (-8.2%)	-240 (-16.7%)	-95 (-6.7%)	-216 (-15.3%)	0 (0%)	0 (0%)
	C	-103 (-12.5%)	-153 (-18.6%)	-71 (-9%)	-122 (-15.4%)	0 (0%)	0 (0%)
	All	-87 (-5.5%)	-175 (-11.2%)	-76 (-4.9%)	-164 (-10.6%)	0 (0%)	0 (0%)

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
May	W	35 (2.1%)	-39 (-2.4%)	13 (0.8%)	-61 (-3.6%)	0 (0%)	1 (0.04%)
	AN	-95 (-6.8%)	-146 (-10.5%)	-101 (-7.2%)	-152 (-10.9%)	2 (0.1%)	0 (0%)
	BN	-145 (-11.7%)	-340 (-27.5%)	-134 (-10.9%)	-329 (-26.8%)	-1 (-0.1%)	0 (0%)
	D	-101 (-8.8%)	-224 (-19.7%)	-66 (-5.9%)	-190 (-17.1%)	0 (0%)	0 (0%)
	C	-67 (-9.4%)	-89 (-12.5%)	-24 (-3.6%)	-47 (-6.9%)	0 (0%)	-1 (-0.2%)
	All	-60 (-4.7%)	-147 (-11.6%)	-52 (-4.1%)	-139 (-11%)	0 (0%)	0 (0%)
Jun	W	178 (11.1%)	154 (9.6%)	168 (10.4%)	143 (8.9%)	0 (0%)	-2 (-0.1%)
	AN	-49 (-4.3%)	-150 (-13.2%)	-58 (-5%)	-159 (-13.9%)	-2 (-0.2%)	-1 (-0.1%)
	BN	-56 (-8.4%)	-96 (-14.4%)	-47 (-7.1%)	-87 (-13.3%)	-2 (-0.3%)	-1 (-0.1%)
	D	-62 (-13.8%)	-82 (-18.4%)	-33 (-7.8%)	-53 (-12.8%)	2 (0.6%)	0 (0%)
	C	-23 (-7.1%)	-40 (-11.9%)	1 (0.4%)	-15 (-4.8%)	0 (0%)	-3 (-1.1%)
	All	19 (2.1%)	-20 (-2.2%)	26 (2.8%)	-14 (-1.5%)	0 (0%)	-1 (-0.2%)
Jul	W	6 (0.5%)	16 (1.5%)	-51 (-4.5%)	-40 (-3.6%)	0 (0%)	0 (0%)
	AN	-33 (-6.8%)	-35 (-7.2%)	-29 (-5.9%)	-31 (-6.3%)	0 (0%)	0 (0%)
	BN	-23 (-5.1%)	-25 (-5.5%)	-3 (-0.6%)	-5 (-1.1%)	0 (0%)	0 (0%)
	D	-43 (-10.7%)	-38 (-9.7%)	10 (2.9%)	14 (4.1%)	0 (0.1%)	0 (0.1%)
	C	-19 (-5.5%)	-25 (-7.5%)	-11 (-3.4%)	-18 (-5.5%)	0 (0%)	1 (0.3%)
	All	-19 (-3.1%)	-17 (-2.8%)	-21 (-3.5%)	-20 (-3.2%)	0 (0%)	0 (0%)
Aug	W	-86 (-9.3%)	-212 (-22.8%)	-94 (-10%)	-220 (-23.5%)	0 (0%)	0 (0%)
	AN	-21 (-4.4%)	-22 (-4.6%)	-21 (-4.4%)	-22 (-4.6%)	0 (0%)	0 (0%)
	BN	-1 (-0.2%)	-4 (-1%)	-1 (-0.3%)	-5 (-1.1%)	0 (0%)	0 (0%)
	D	-3 (-0.7%)	-5 (-1.2%)	-3 (-0.8%)	-5 (-1.3%)	0 (0%)	0 (0%)
	C	0.3 (0.1%)	-2 (-0.6%)	-19 (-5.3%)	-22 (-6%)	0 (0%)	1 (0.3%)
	All	-30 (-5.3%)	-68 (-12.2%)	-36 (-6.4%)	-74 (-13.1%)	0 (0%)	0 (0%)
Sep	W	-76 (-7.3%)	-177 (-17%)	-63 (-6.1%)	-165 (-16%)	-1 (-0.1%)	0 (0%)
	AN	-25 (-5%)	-28 (-5.6%)	-25 (-5%)	-28 (-5.6%)	0 (0%)	0 (0%)
	BN	-4 (-0.9%)	-10 (-2.4%)	-4 (-0.9%)	-10 (-2.4%)	0 (0%)	0 (0%)
	D	-3 (-0.7%)	-5 (-1.3%)	-3 (-0.8%)	-5 (-1.3%)	0 (0%)	0 (0%)
	C	3 (0.9%)	5 (1.6%)	-12 (-3.7%)	-10 (-3%)	0 (0%)	13 (4.1%)
	All	-27 (-4.6%)	-59 (-9.9%)	-27 (-4.5%)	-58 (-9.8%)	0 (0%)	3 (0.5%)
Oct	W	-28 (-3.2%)	-52 (-5.8%)	-39 (-4.3%)	-62 (-6.8%)	0 (0%)	0 (0.1%)
	AN	-29 (-3.3%)	-48 (-5.5%)	-28 (-3.3%)	-48 (-5.5%)	0 (0%)	2 (0.3%)
	BN	-52 (-5.7%)	-59 (-6.5%)	-52 (-5.7%)	-59 (-6.5%)	0 (0%)	0 (0%)
	D	-4 (-0.4%)	-59 (-6%)	-4 (-0.4%)	-59 (-6%)	0 (0%)	0 (0%)
	C	-19 (-2.8%)	-75 (-10.9%)	-18 (-2.6%)	-73 (-10.7%)	0 (0%)	1 (0.2%)
	All	-27 (-3.1%)	-58 (-6.7%)	-29 (-3.4%)	-61 (-7%)	0 (0%)	1 (0.1%)
Nov	W	1 (0.3%)	-18 (-4.3%)	3 (0.6%)	-17 (-3.9%)	0 (0%)	0 (0%)
	AN	11 (1.9%)	-56 (-9.7%)	17 (3%)	-50 (-8.7%)	0 (0%)	0 (0%)
	BN	0 (0%)	-8 (-2.3%)	0 (0%)	-8 (-2.3%)	0 (0%)	0 (0%)
	D	-8 (-2.2%)	-23 (-6.7%)	-8 (-2.2%)	-23 (-6.7%)	0 (0%)	0 (0%)
	C	-14 (-4.2%)	-16 (-5.1%)	-15 (-4.5%)	-18 (-5.4%)	0 (0%)	0 (0%)
	All	-1 (-0.3%)	-24 (-5.9%)	0 (0%)	-23 (-5.6%)	0 (0%)	0 (0%)

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Dec	W	14 (2.7%)	-72 (-14%)	-3 (-0.7%)	-89 (-16.7%)	0 (0%)	12 (2.8%)
	AN	44 (6.2%)	-25 (-3.5%)	56 (7.9%)	-14 (-1.9%)	0 (0%)	0 (0%)
	BN	0 (0%)	23 (6.8%)	0 (0%)	23 (6.8%)	0 (0%)	0 (0%)
	D	-8 (-2.4%)	-23 (-7.3%)	-8 (-2.4%)	-23 (-7.3%)	0 (0%)	0 (0%)
	C	-13 (-4.7%)	-16 (-5.7%)	-15 (-5.1%)	-18 (-6.1%)	0 (0%)	0 (0%)
	All	9 (2%)	-29 (-6.5%)	6 (1.3%)	-32 (-7.1%)	0 (0%)	3 (0.8%)

[a] Positive values indicate higher flows under ESO than under EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

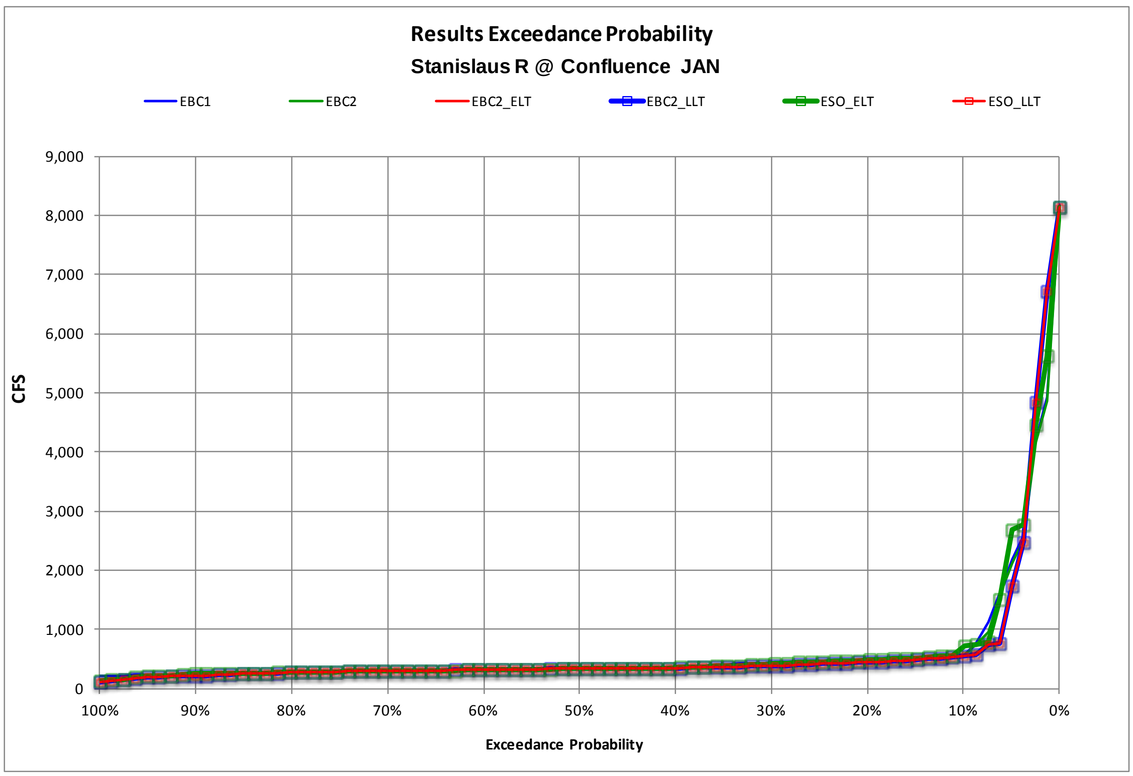


Figure 5C.5.2-181. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Stanislaus River at the Confluence with the San Joaquin River, January

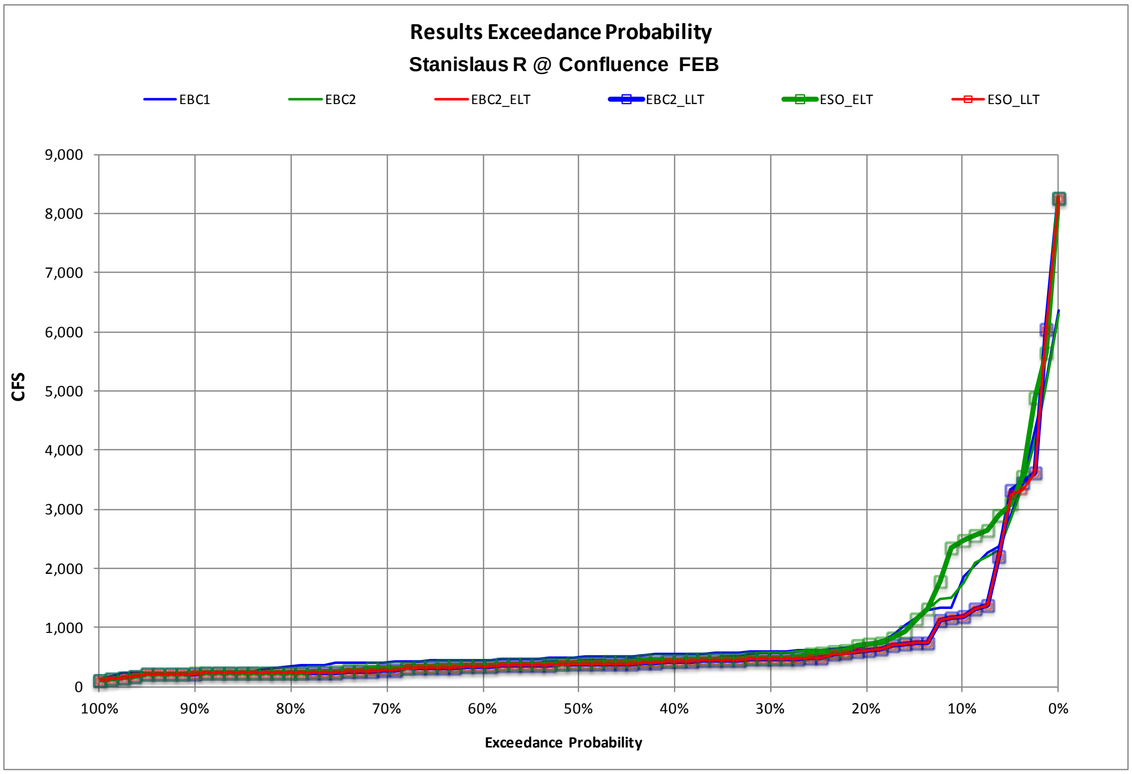


Figure 5C.5.2-182. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Stanislaus River at the Confluence with the San Joaquin River, February

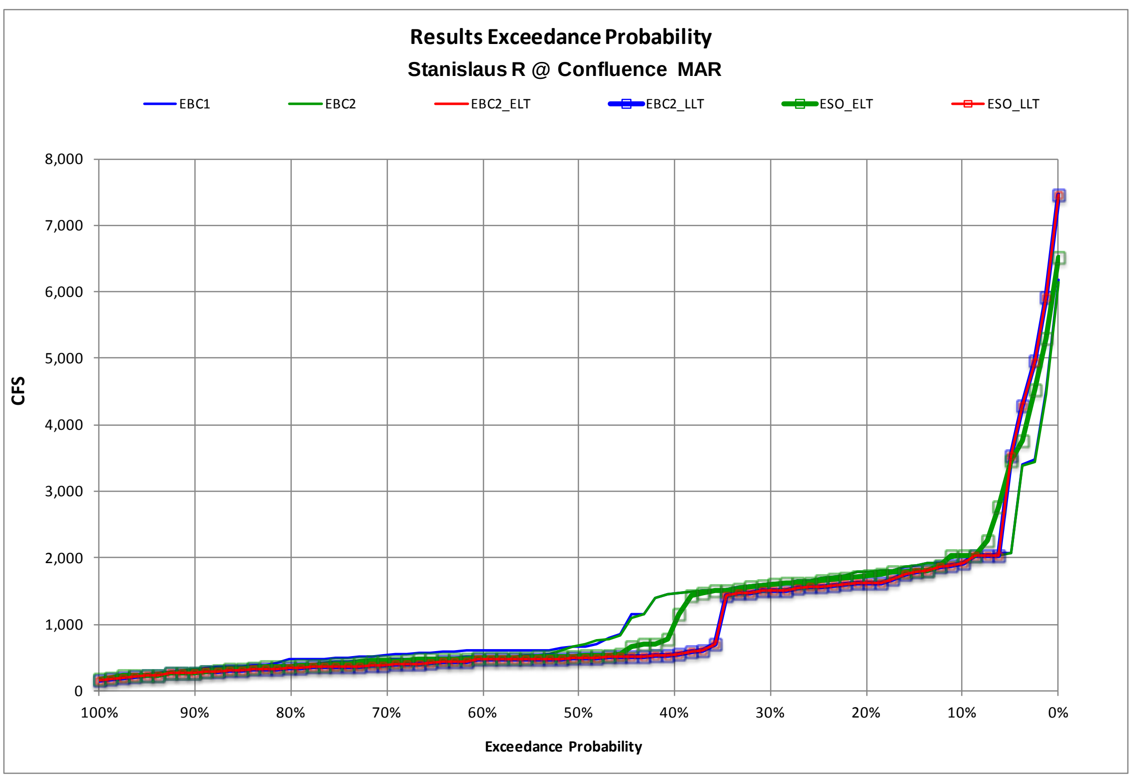


Figure 5C.5.2-183. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Stanislaus River at the Confluence with the San Joaquin River, March

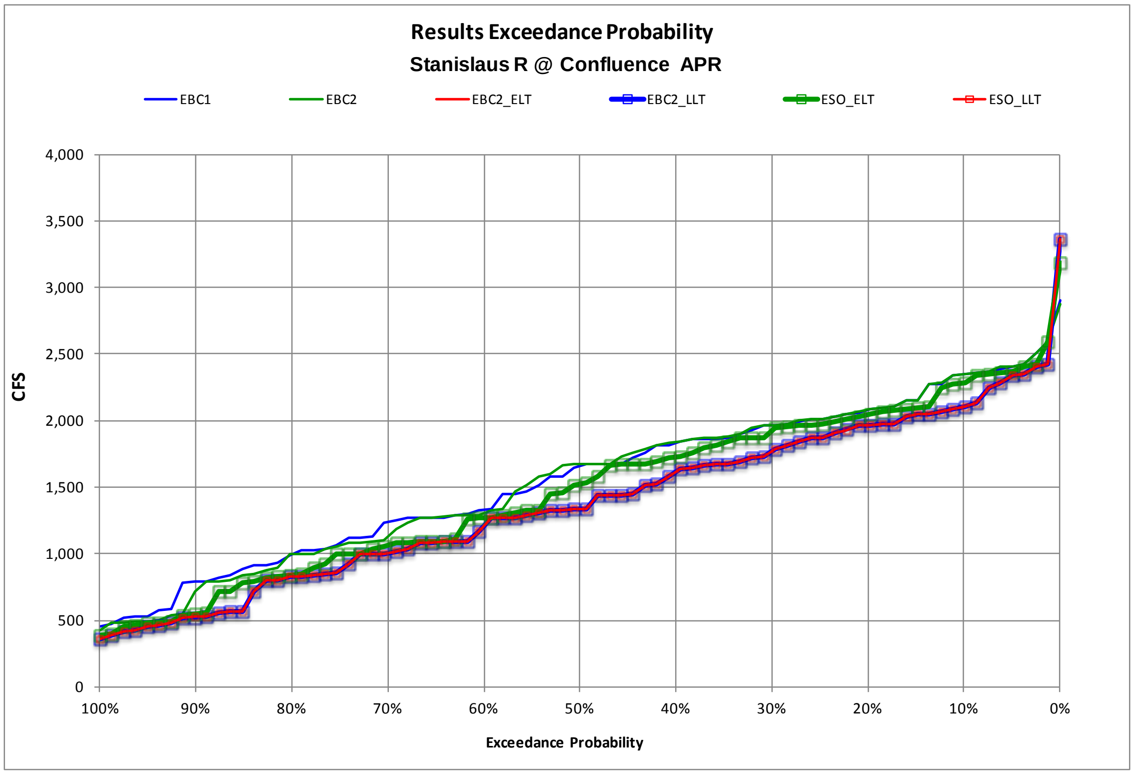


Figure 5C.5.2-184. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Stanislaus River at the Confluence with the San Joaquin River, April

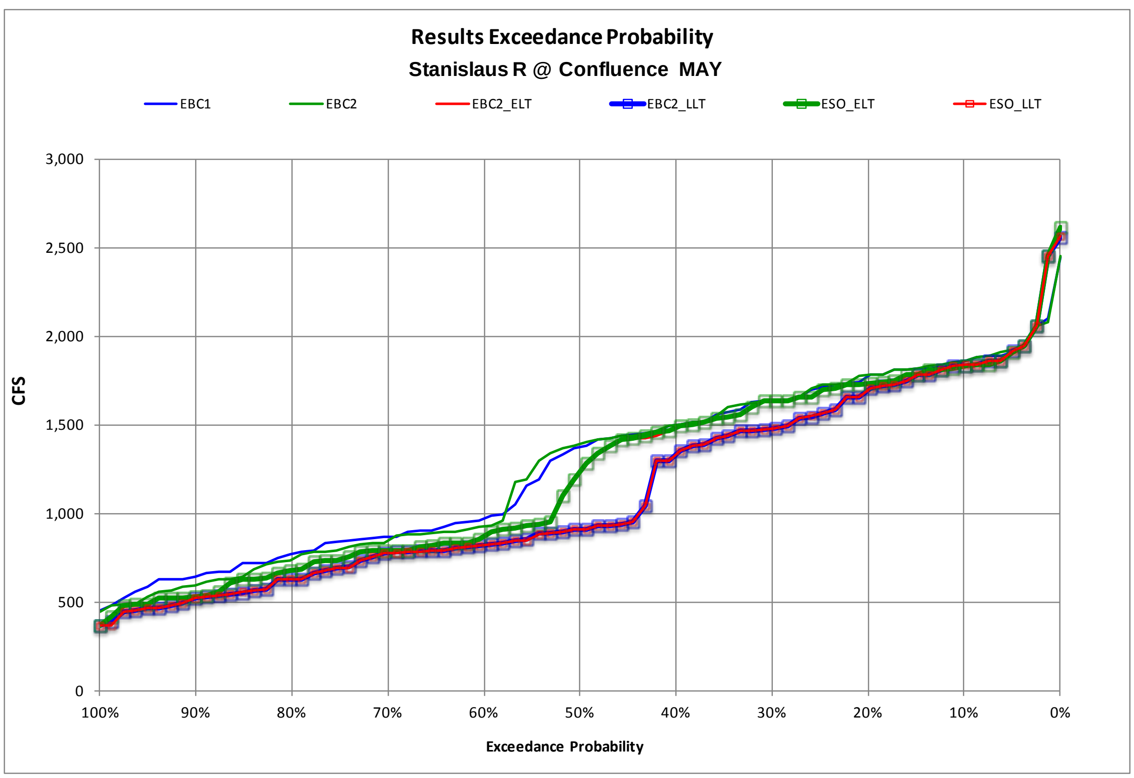


Figure 5C.5.2-185. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Stanislaus River at the Confluence with the San Joaquin River, May

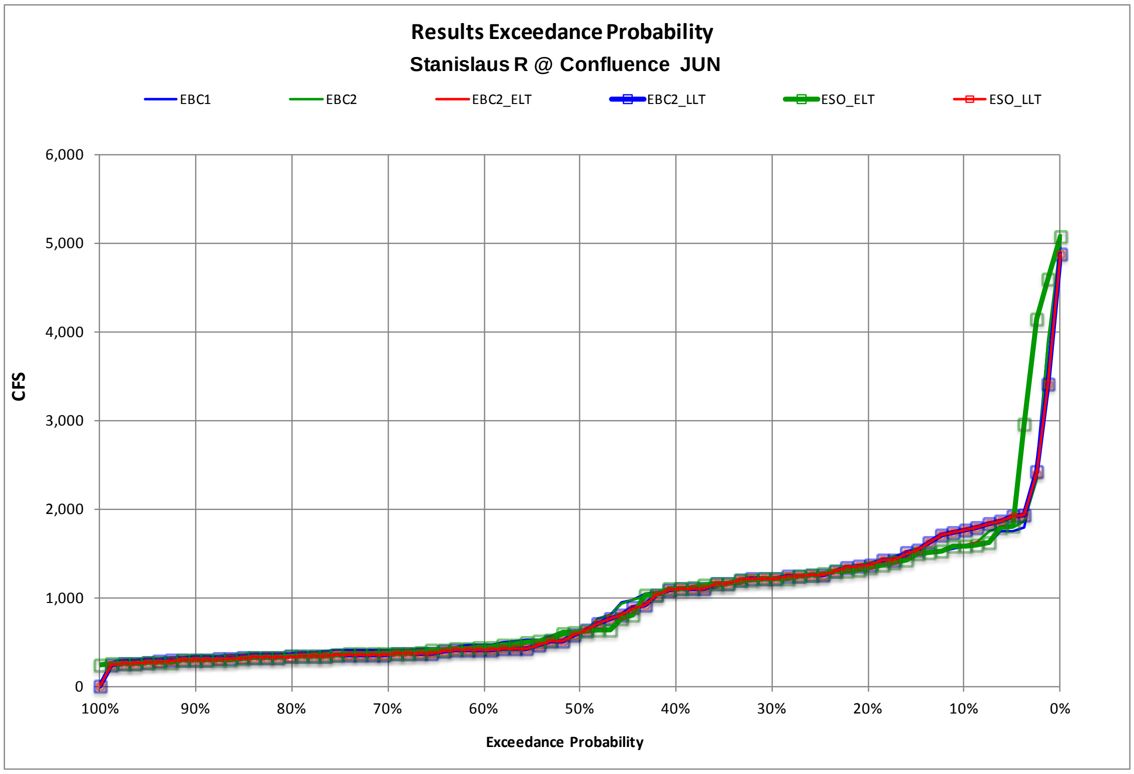


Figure 5C.5.2-186. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Stanislaus River at the Confluence with the San Joaquin River, June

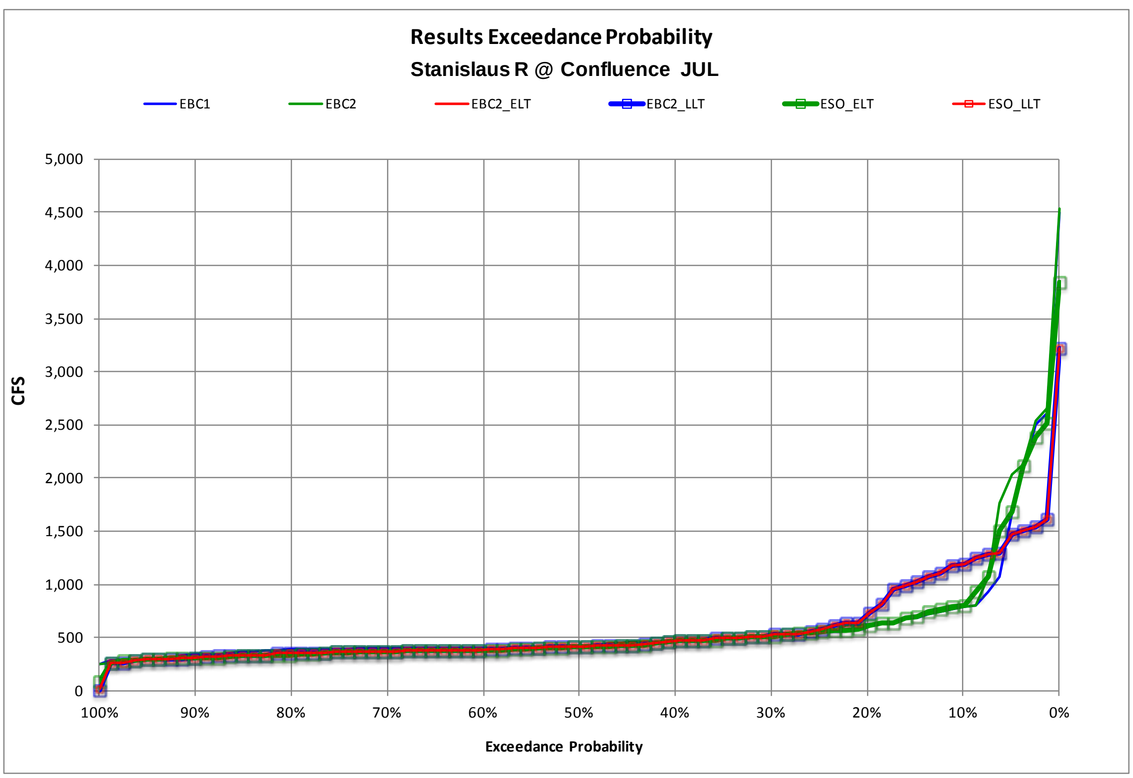


Figure 5C.5.2-187. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Stanislaus River at the Confluence with the San Joaquin River, July

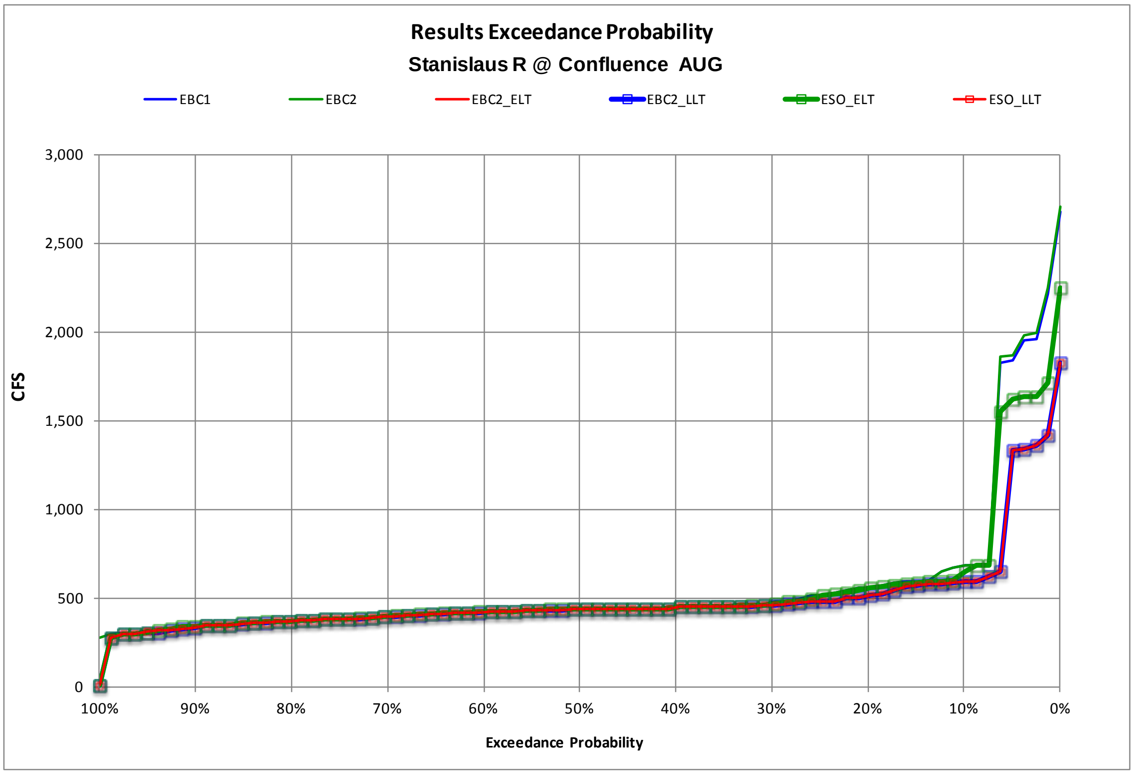


Figure 5C.5.2-188. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Stanislaus River at the Confluence with the San Joaquin River, August

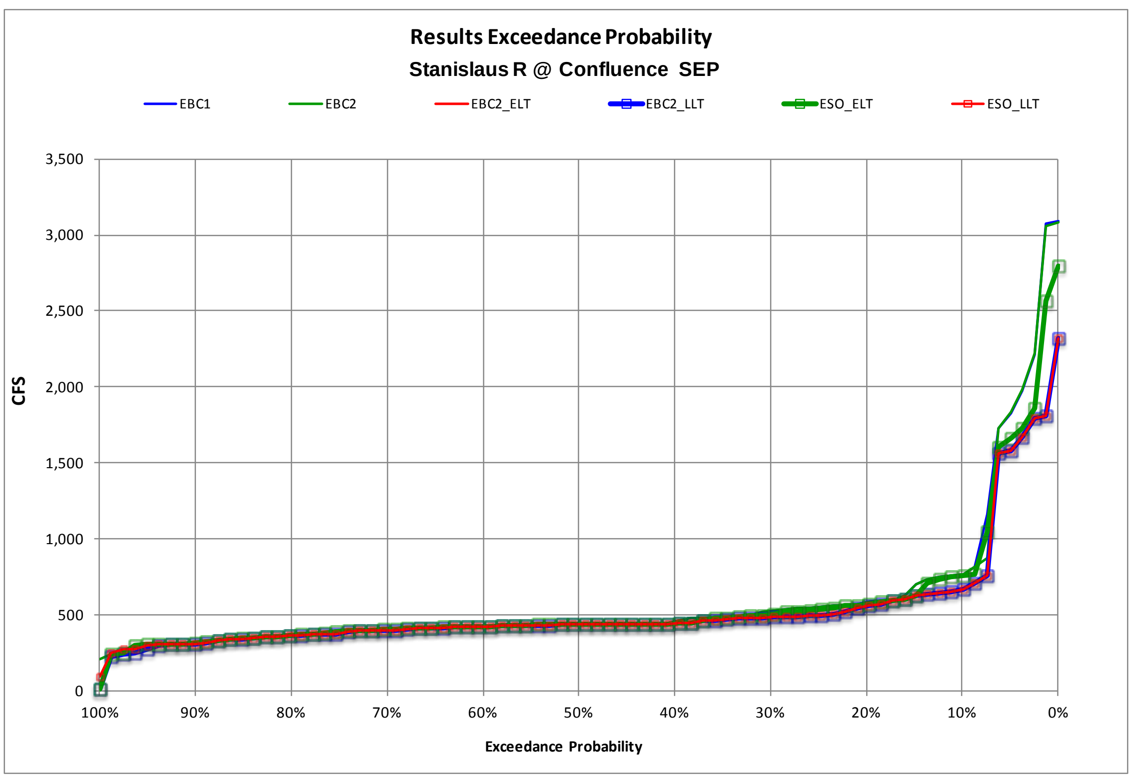


Figure 5C.5.2-189. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Stanislaus River at the Confluence with the San Joaquin River, September

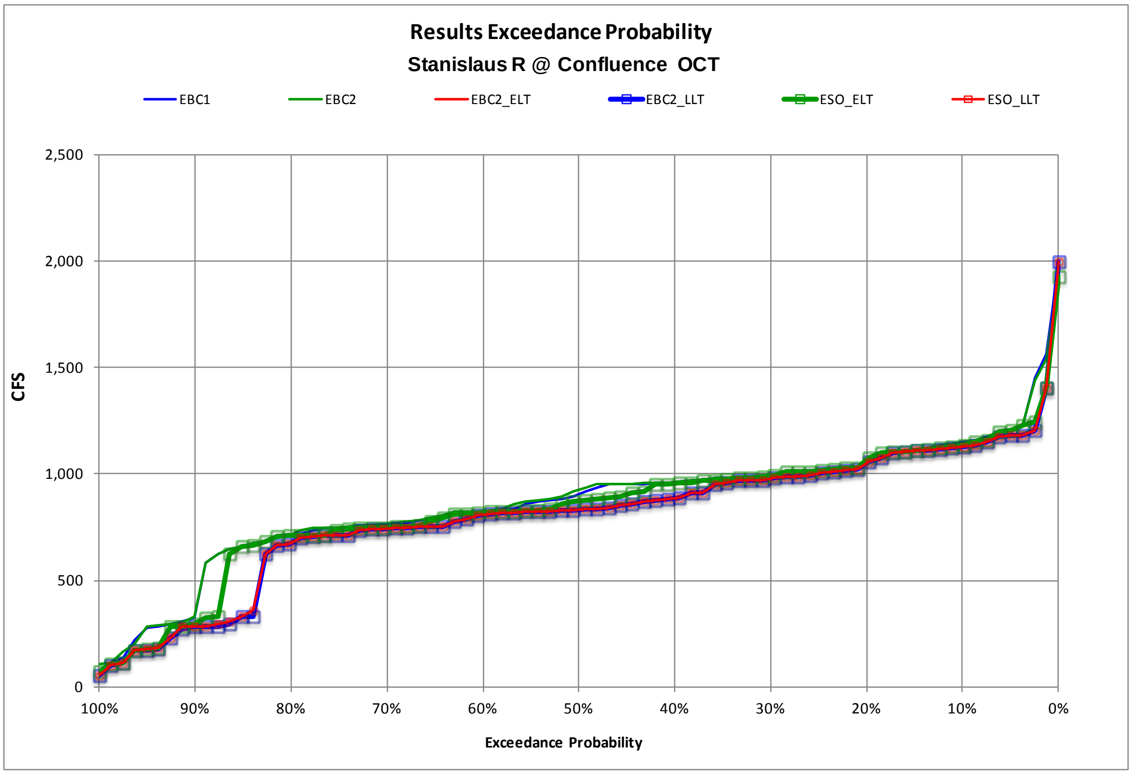


Figure 5C.5.2-190. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Stanislaus River at the Confluence with the San Joaquin River, October

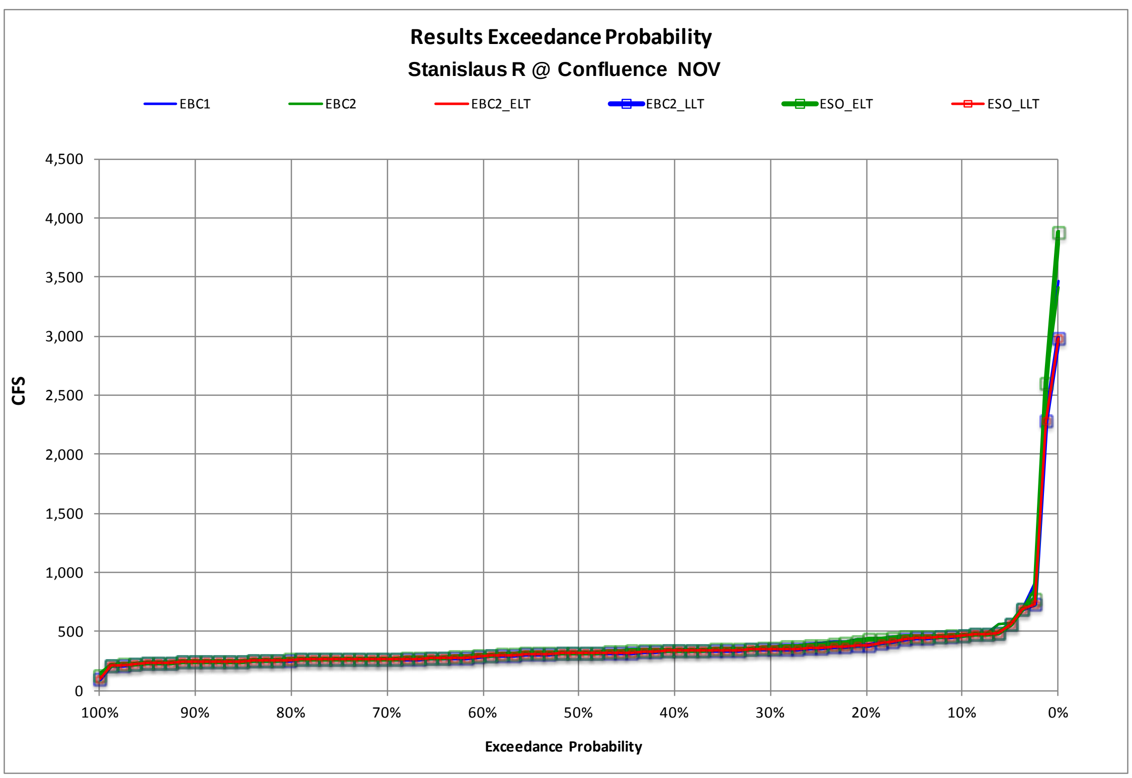


Figure 5C.5.2-191. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Stanislaus River at the Confluence with the San Joaquin River, November

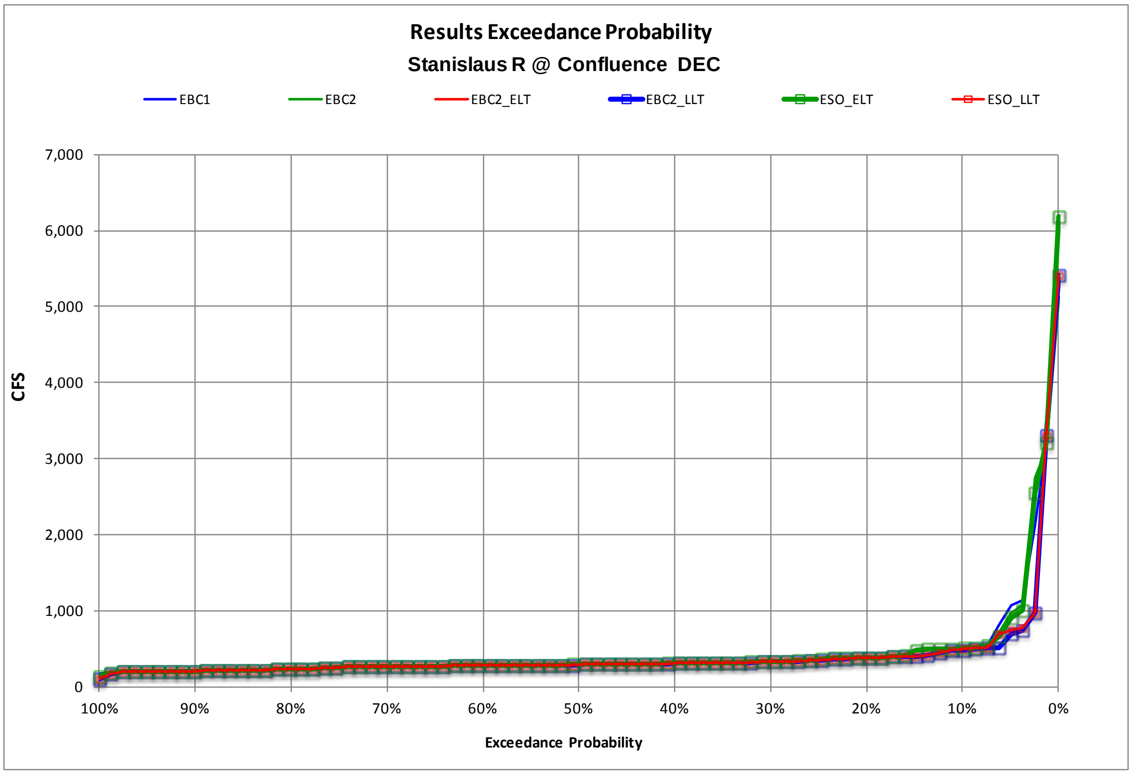


Figure 5C.5.2-192. Probability of Exceedance Plot for EBC and ESO Scenarios of Mean Monthly Flow in the Stanislaus River at the Confluence with the San Joaquin River, December

Table 5C.5.2-265. Mean Monthly Flows (cfs) in the Stanislaus River at the Confluence with the San Joaquin River for ESO, HOS, and LOS Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	968	885	968	885	968	885
	AN	912	963	912	963	912	963
	BN	382	369	382	369	382	369
	D	393	366	393	366	393	366
	C	278	265	278	265	278	265
	All	638	615	638	615	638	615
Feb	W	1,500	1,227	1,502	1,243	1,500	1,226
	AN	985	858	985	858	985	858
	BN	522	437	522	438	522	438
	D	410	359	410	359	410	359
	C	349	348	349	348	349	348
	All	847	721	848	725	847	721
Mar	W	2,259	2,217	2,259	2,217	2,260	2,217
	AN	1,108	956	1,108	956	1,108	956
	BN	642	548	642	548	642	548
	D	431	390	431	390	431	390
	C	445	444	444	443	445	444
	All	1,134	1,071	1,134	1,070	1,135	1,071

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Apr	W	2,047	1,965	2,047	1,965	2,047	1,965
	AN	1,605	1,535	1,605	1,534	1,605	1,535
	BN	1,344	1,211	1,344	1,211	1,344	1,210
	D	1,320	1,199	1,319	1,198	1,320	1,198
	C	720	669	719	668	721	670
	All	1,475	1,387	1,475	1,387	1,475	1,387
May	W	1,688	1,614	1,688	1,614	1,688	1,614
	AN	1,294	1,243	1,292	1,243	1,294	1,243
	BN	1,093	898	1,093	898	1,093	898
	D	1,039	916	1,039	915	1,040	916
	C	648	626	646	625	648	627
	All	1,211	1,125	1,210	1,124	1,211	1,125
Jun	W	1,785	1,761	1,789	1,765	1,785	1,761
	AN	1,085	984	1,087	984	1,084	984
	BN	607	567	608	567	606	566
	D	385	364	383	364	383	365
	C	308	292	307	289	309	292
	All	952	912	953	913	951	912
Jul	W	1,069	1,080	1,069	1,080	1,070	1,080
	AN	456	454	456	454	456	454
	BN	427	425	427	425	427	425
	D	355	360	355	358	356	360
	C	318	311	317	307	317	313
	All	588	590	588	589	588	590
Aug	W	843	717	843	717	843	717
	AN	455	454	455	454	455	454
	BN	422	418	422	418	422	418
	D	384	382	384	382	384	382
	C	341	339	338	334	341	338
	All	530	492	529	491	530	492
Sep	W	965	863	965	863	965	863
	AN	477	474	477	474	477	474
	BN	413	407	413	407	413	407
	D	392	390	392	390	392	390
	C	327	330	327	329	327	331
	All	567	536	567	536	567	536
Oct	W	869	846	869	846	869	846
	AN	844	825	844	825	844	825
	BN	851	844	851	844	851	844
	D	980	925	980	925	980	925
	C	670	614	669	612	669	612
	All	840	809	840	808	840	808

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Nov	W	427	408	427	408	427	408
	AN	591	524	591	524	591	524
	BN	341	334	341	334	341	334
	D	337	321	337	321	337	321
	C	311	308	311	308	311	308
	All	409	386	409	386	409	386
Dec	W	526	441	526	418	526	441
	AN	767	697	767	697	767	697
	BN	331	353	331	353	331	353
	D	310	294	310	294	310	294
	C	275	272	275	272	275	272
	All	459	421	459	414	459	421

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-266. Differences[a] between ESO Scenarios and HOS and LOS Scenarios in Mean Monthly Flows (cfs) in the Stanislaus River at the Confluence with the San Joaquin River

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	W	2 (0.1%)	16 (1.3%)	0 (0%)	-1 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	1 (0.2%)	0 (0%)	1 (0.2%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	1 (0.1%)	5 (0.7%)	0 (0%)	0 (0%)
Mar	W	0 (0%)	0 (0%)	1 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (-0.1%)	0 (0%)	0 (0%)
	C	-1 (-0.1%)	-1 (-0.2%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	-1 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	-1 (0%)	-1 (0%)	0 (0%)	0 (0%)
	C	-1 (-0.1%)	-1 (-0.2%)	1 (0.1%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
May	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	-1 (-0.1%)	1 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	-1 (-0.1%)	-1 (-0.1%)	0 (0%)	0 (0%)
	C	-2 (-0.2%)	0 (-0.1%)	0 (0.1%)	1 (0.1%)
	All	-1 (-0.1%)	0 (0%)	0 (0%)	0 (0%)
Jun	W	4 (0.2%)	4 (0.2%)	0 (0%)	0 (0%)
	AN	2 (0.2%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0.1%)	0 (0%)	-1 (-0.2%)	-1 (-0.2%)
	D	-2 (-0.5%)	0 (0%)	-2 (-0.6%)	0 (0%)
	C	-2 (-0.6%)	-4 (-1.3%)	1 (0.2%)	0 (-0.1%)
	All	1 (0.1%)	0 (0%)	0 (-0.1%)	0 (0%)
Jul	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0.1%)
	D	0 (-0.1%)	-1 (-0.4%)	0 (0.1%)	1 (0.2%)
	C	-2 (-0.5%)	-4 (-1.3%)	-1 (-0.5%)	1 (0.4%)
	All	0 (-0.1%)	-1 (-0.2%)	0 (0%)	0 (0.1%)
Aug	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	-3 (-0.9%)	-5 (-1.4%)	0 (0%)	-1 (-0.2%)
	All	-1 (-0.1%)	-1 (-0.2%)	0 (0%)	0 (0%)
Sep	W	1 (0.1%)	0 (0%)	1 (0.1%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	-1 (-0.3%)	0 (0%)	1 (0.3%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Oct	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	-2 (-0.3%)	0 (0%)	-2 (-0.3%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Dec	W	0 (0%)	-23 (-5.2%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	-7 (-1.6%)	0 (0%)	0 (0%)

[a] Positive values indicate higher flows under HOS or LOS than under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Water Temperature

Water temperature in the Stanislaus River during the steelhead spawning and egg incubation period is determined largely by coldwater pool storage in New Melones Reservoir and instream flow releases. Results of water temperature simulation analyses for the Stanislaus River at Orange Blossom Bridge were used as an indicator of effects of the ESO on water temperatures that would potentially affect steelhead spawning and egg incubation. Predicted average water temperatures by month and water-year type for the Stanislaus River at Orange Blossom Bridge are presented in Table 5C.5.2-267 and differences between model scenarios are presented in Table 5C.5.2-268. These results indicate that there would be no differences in mean monthly water temperatures between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT regardless of month or water-year type. Further there would be no differences in mean monthly water temperatures at Orange Blossom Bridge between the ESO scenarios and HOS and LOS scenarios (Table 5C.5.2-269, Table 5C.5.2-270). Overall, these results indicate that there would be no effect of ESO, HOS, or LOS scenarios on water temperatures in the Stanislaus River during the primary spawning and egg incubation period.

Table 5C.5.2-267. Mean Monthly Water Temperature (°F) in the Stanislaus River at Orange Blossom Bridge under EBC and ESO Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	48	48	49	51	49	51
	AN	48	48	49	51	49	51
	BN	48	48	49	51	49	51
	D	47	47	48	50	48	50
	C	48	48	49	51	49	51
	All	48	48	49	51	49	51
Feb	W	49	49	50	52	50	52
	AN	49	49	51	52	51	52
	BN	49	49	51	52	51	52
	D	49	49	51	52	51	52
	C	50	50	52	53	52	53
	All	49	49	51	52	51	52

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Mar	W	49	49	51	53	51	53
	AN	50	50	52	54	52	54
	BN	52	52	53	55	53	55
	D	52	52	54	56	54	56
	C	53	53	54	56	54	56
	All	51	51	53	54	53	54
Apr	W	50	50	52	53	52	53
	AN	51	51	53	54	53	54
	BN	52	52	54	56	54	56
	D	53	53	54	56	54	56
	C	55	55	56	58	56	58
	All	52	52	54	55	54	55
May	W	53	53	54	56	54	56
	AN	54	54	56	57	56	57
	BN	55	55	57	59	57	59
	D	56	56	58	60	58	60
	C	58	58	60	61	60	61
	All	55	55	57	58	57	58
Jun	W	56	56	57	58	57	58
	AN	58	58	60	62	60	62
	BN	60	60	62	64	62	64
	D	62	62	65	66	64	66
	C	63	63	65	67	65	67
	All	59	59	61	63	61	63
Jul	W	60	60	61	62	61	62
	AN	63	63	65	66	65	66
	BN	63	64	65	67	65	67
	D	64	65	66	68	66	68
	C	65	65	67	69	67	69
	All	63	63	65	66	65	66
Aug	W	60	60	62	64	62	64
	AN	63	62	64	66	64	66
	BN	63	63	65	66	65	66
	D	64	64	66	68	66	68
	C	65	64	67	69	67	69
	All	63	63	64	66	64	66
Sep	W	60	60	62	64	62	64
	AN	63	63	64	66	64	66
	BN	63	63	65	67	65	67
	D	63	63	65	67	65	67
	C	64	64	66	68	66	68
	All	62	62	64	66	64	66

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Oct	W	59	59	61	62	61	62
	AN	59	59	61	62	61	62
	BN	59	59	60	62	60	62
	D	59	59	60	62	60	62
	C	60	60	62	64	62	64
	All	59	59	61	62	61	62
Nov	W	55	55	56	58	56	58
	AN	55	55	56	58	56	58
	BN	55	55	56	58	56	58
	D	55	55	56	58	56	58
	C	56	56	57	59	57	59
	All	55	55	57	58	57	58
Dec	W	50	50	52	54	52	54
	AN	50	50	51	53	51	53
	BN	49	49	51	53	51	53
	D	50	50	51	52	51	52
	C	50	50	51	53	51	53
	All	50	50	51	53	51	53

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-268. Differences[a] between EBC and ESO Scenarios in Mean Monthly Water Temperature (°F) in the Stanislaus River at Orange Blossom Bridge

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	1 (2.8%)	3 (6.2%)	1 (2.9%)	3 (6.3%)	0 (0%)	0 (0%)
	AN	1 (3.1%)	3 (6.3%)	1 (3%)	3 (6.3%)	0 (0%)	0 (0%)
	BN	1 (2.9%)	3 (6.1%)	1 (2.8%)	3 (6.1%)	0 (0%)	0 (0%)
	D	1 (2.9%)	3 (5.9%)	1 (2.8%)	3 (5.9%)	0 (0%)	0 (0%)
	C	1 (2.6%)	3 (5.8%)	1 (3%)	3 (6.2%)	0 (0%)	0 (0%)
	All	1 (2.8%)	3 (6.1%)	1 (2.9%)	3 (6.2%)	0 (0%)	0 (0%)
Feb	W	1 (2.6%)	3 (6.3%)	1 (2.7%)	3 (6.4%)	0 (0%)	0 (0%)
	AN	1 (2.9%)	3 (6.3%)	1 (3%)	3 (6.4%)	0 (0%)	0 (0%)
	BN	2 (3.1%)	3 (6%)	2 (3.1%)	3 (5.9%)	0 (0%)	0 (0%)
	D	2 (3.3%)	3 (6.5%)	2 (3.2%)	3 (6.3%)	0 (0%)	0 (0%)
	C	2 (3.1%)	3 (6.3%)	2 (3.1%)	3 (6.2%)	0 (0%)	0 (0%)
	All	1 (3%)	3 (6.3%)	1 (3%)	3 (6.3%)	0 (0%)	0 (0%)
Mar	W	1 (2.5%)	3 (6.4%)	1 (2.6%)	3 (6.5%)	0 (0%)	0 (0%)
	AN	2 (3.5%)	4 (7.3%)	2 (3.5%)	4 (7.3%)	0 (0%)	0 (0%)
	BN	1 (2.9%)	3 (5.8%)	1 (2.9%)	3 (5.8%)	0 (0%)	0 (0%)
	D	2 (3.3%)	3 (6.6%)	2 (3.2%)	3 (6.5%)	0 (0%)	0 (0%)
	C	1 (2.7%)	3 (5.8%)	1 (2.5%)	3 (5.6%)	0 (0%)	0 (0%)
	All	1 (2.9%)	3 (6.4%)	1 (2.9%)	3 (6.4%)	0 (0%)	0 (0%)

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Apr	W	1 (2.9%)	3 (6.1%)	1 (2.9%)	3 (6.1%)	0 (0%)	0 (0%)
	AN	2 (3.1%)	3 (6.5%)	2 (3%)	3 (6.4%)	0 (0%)	0 (0%)
	BN	2 (3.4%)	3 (6.7%)	2 (3.3%)	3 (6.6%)	0 (0%)	0 (0%)
	D	2 (3.3%)	4 (6.8%)	2 (3.2%)	4 (6.7%)	0 (0%)	0 (0%)
	C	2 (3.1%)	4 (6.6%)	2 (3.1%)	4 (6.6%)	0 (0%)	0 (0%)
	All	2 (3.1%)	3 (6.5%)	2 (3.1%)	3 (6.4%)	0 (0%)	0 (0%)
May	W	2 (3%)	3 (6%)	2 (3%)	3 (6%)	0 (0%)	0 (0%)
	AN	2 (3.1%)	3 (6%)	2 (3.1%)	3 (6%)	0 (0%)	0 (0%)
	BN	2 (3.9%)	4 (7.1%)	2 (3.8%)	4 (7%)	0 (0%)	0 (0%)
	D	2 (3.5%)	4 (6.5%)	2 (3.2%)	3 (6.2%)	0 (0%)	0 (0%)
	C	2 (3.4%)	3 (6%)	2 (3.3%)	3 (5.9%)	0 (0%)	0 (0%)
	All	2 (3.3%)	3 (6.2%)	2 (3.3%)	3 (6.2%)	0 (0%)	0 (0%)
Jun	W	1 (2.5%)	2 (4.1%)	1 (2.5%)	2 (4.1%)	0 (0%)	0 (0%)
	AN	2 (3%)	4 (6.6%)	2 (2.9%)	4 (6.5%)	0 (0%)	0 (0%)
	BN	2 (3.4%)	4 (6.5%)	2 (3.4%)	4 (6.4%)	0 (0%)	0 (0%)
	D	2 (4%)	4 (6.9%)	2 (3.3%)	4 (6.2%)	0 (0%)	0 (0%)
	C	2 (3.4%)	4 (6.7%)	2 (2.7%)	4 (6%)	0 (0%)	0.1 (0.2%)
	All	2 (3.2%)	4 (6%)	2 (2.9%)	3 (5.7%)	0 (0%)	0 (0%)
Jul	W	1 (2.4%)	2 (3.5%)	2 (2.6%)	2 (3.7%)	0 (0%)	0 (0%)
	AN	2 (3.3%)	4 (5.7%)	2 (3.1%)	3 (5.5%)	0 (0%)	0 (0%)
	BN	2 (3.2%)	4 (5.6%)	2 (2.8%)	3 (5.1%)	0 (0%)	0 (0%)
	D	2 (3.6%)	4 (5.9%)	2 (2.5%)	3 (4.9%)	0 (0%)	0 (0%)
	C	2 (3.4%)	4 (6.2%)	2 (3.1%)	4 (5.9%)	0 (0%)	0 (0%)
	All	2 (3.1%)	3 (5.2%)	2 (2.8%)	3 (4.9%)	0 (0%)	0 (0%)
Aug	W	2 (2.9%)	4 (6.4%)	2 (2.9%)	4 (6.3%)	0 (0%)	0 (0%)
	AN	2 (3%)	4 (5.7%)	2 (3%)	4 (5.7%)	0 (0%)	0 (0%)
	BN	2 (2.8%)	3 (5.5%)	2 (2.7%)	3 (5.4%)	0 (0%)	0 (0%)
	D	2 (2.8%)	3 (5.5%)	2 (2.7%)	3 (5.5%)	0 (0%)	0 (0%)
	C	2 (3.6%)	4 (6.5%)	3 (3.9%)	4 (6.8%)	0 (0%)	0 (0%)
	All	2 (3%)	4 (6%)	2 (3.1%)	4 (6%)	0 (0%)	0 (0%)
Sep	W	2 (2.8%)	4 (6.3%)	2 (2.7%)	4 (6.2%)	0 (0%)	0 (0%)
	AN	2 (3%)	4 (6.2%)	2 (3.1%)	4 (6.3%)	0 (0%)	0 (0%)
	BN	2 (2.9%)	4 (6%)	2 (2.8%)	4 (5.9%)	0 (0%)	0 (0%)
	D	2 (2.8%)	4 (5.9%)	2 (2.9%)	4 (5.9%)	0 (0%)	0 (0%)
	C	2 (3.2%)	4 (6%)	2 (3.9%)	4 (6.6%)	0 (0%)	-0.1 (-0.1%)
	All	2 (3%)	4 (6.1%)	2 (3.1%)	4 (6.2%)	0 (0%)	0 (0%)
Oct	W	2 (2.6%)	3 (5.6%)	2 (2.8%)	3 (5.7%)	0 (0%)	0 (0%)
	AN	1 (2.4%)	3 (5.1%)	2 (2.6%)	3 (5.3%)	0 (0%)	0 (0%)
	BN	1 (2.5%)	3 (5.4%)	1 (2.5%)	3 (5.4%)	0 (0%)	0 (0%)
	D	2 (2.7%)	3 (5.7%)	2 (2.7%)	3 (5.7%)	0 (0%)	0 (0%)
	C	2 (2.8%)	4 (5.9%)	2 (3%)	4 (6.2%)	0 (0%)	0 (0%)
	All	2 (2.6%)	3 (5.6%)	2 (2.7%)	3 (5.7%)	0 (0%)	0 (0%)

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Nov	W	1 (2.5%)	3 (5.7%)	1 (2.6%)	3 (5.8%)	0 (0%)	0 (0%)
	AN	1 (2.4%)	3 (5.5%)	1 (2.6%)	3 (5.7%)	0 (0%)	0 (0%)
	BN	1 (2.6%)	3 (5.8%)	1 (2.6%)	3 (5.8%)	0 (0%)	0 (0%)
	D	1 (2.5%)	3 (5.9%)	1 (2.5%)	3 (5.9%)	0 (0%)	0 (0%)
	C	1 (2.5%)	3 (5.7%)	2 (2.7%)	3 (6%)	0 (0%)	0 (0%)
	All	1 (2.5%)	3 (5.7%)	1 (2.6%)	3 (5.8%)	0 (0%)	0 (0%)
Dec	W	1 (2.7%)	3 (6.4%)	1 (2.8%)	3 (6.5%)	0 (0%)	0 (0%)
	AN	1 (2.6%)	3 (5.9%)	1 (2.6%)	3 (5.9%)	0 (0%)	0 (0%)
	BN	1 (2.8%)	3 (6.6%)	1 (2.7%)	3 (6.6%)	0 (0%)	0 (0%)
	D	1 (2.5%)	3 (6%)	1 (2.5%)	3 (6%)	0 (0%)	0 (0%)
	C	1 (2.5%)	3 (6.2%)	1 (2.6%)	3 (6.2%)	0 (0%)	0 (0%)
	All	1 (2.6%)	3 (6.2%)	1 (2.7%)	3 (6.3%)	0 (0%)	0 (0%)

[a] Positive values indicate higher water temperature under ESO than under EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-269. Mean Monthly Water Temperature (°F) in the Stanislaus River at Orange Blossom Bridge for ESO, HOS, and LOS Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	49	51	49	51	49	51
	AN	49	51	49	51	49	51
	BN	49	51	49	51	49	51
	D	48	50	48	50	48	50
	C	49	51	49	51	49	51
	All	49	51	49	51	49	51
Feb	W	50	52	50	52	50	52
	AN	51	52	51	52	51	52
	BN	51	52	51	52	51	52
	D	51	52	51	52	51	52
	C	52	53	52	53	52	53
	All	51	52	51	52	51	52
Mar	W	51	53	51	53	51	53
	AN	52	54	52	54	52	54
	BN	53	55	53	55	53	55
	D	54	56	54	56	54	56
	C	54	56	54	56	54	56
	All	53	54	53	54	53	54
Apr	W	52	53	52	53	52	53
	AN	53	54	53	54	53	54
	BN	54	56	54	56	54	56
	D	54	56	54	56	54	56
	C	56	58	56	58	56	58
	All	54	55	54	55	54	55

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
May	W	54	56	54	56	54	56
	AN	56	57	56	57	56	57
	BN	57	59	57	59	57	59
	D	58	60	58	60	58	60
	C	60	61	60	61	60	61
	All	57	58	57	58	57	58
Jun	W	57	58	57	58	57	58
	AN	60	62	60	62	60	62
	BN	62	64	62	64	62	64
	D	64	66	65	66	65	66
	C	65	67	65	67	65	67
	All	61	63	61	63	61	63
Jul	W	61	62	61	62	61	62
	AN	65	66	65	66	65	66
	BN	65	67	65	67	65	67
	D	66	68	66	68	66	68
	C	67	69	67	69	67	69
	All	65	66	65	66	65	66
Aug	W	62	64	62	64	62	64
	AN	64	66	64	66	64	66
	BN	65	66	65	66	65	66
	D	66	68	66	68	66	68
	C	67	69	67	69	67	69
	All	64	66	64	66	64	66
Sep	W	62	64	62	64	62	64
	AN	64	66	64	66	64	66
	BN	65	67	65	67	65	67
	D	65	67	65	67	65	67
	C	66	68	66	68	66	68
	All	64	66	64	66	64	66
Oct	W	61	62	61	62	61	62
	AN	61	62	61	62	61	62
	BN	60	62	60	62	60	62
	D	60	62	60	62	60	62
	C	62	64	62	64	62	64
	All	61	62	61	63	61	62
Nov	W	56	58	56	58	56	58
	AN	56	58	56	58	56	58
	BN	56	58	56	58	56	58
	D	56	58	56	58	56	58
	C	57	59	57	59	57	59
	All	57	58	57	58	57	58

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Dec	W	52	54	52	53	52	54
	AN	51	53	51	53	51	53
	BN	51	53	51	53	51	53
	D	51	52	51	52	51	52
	C	51	53	51	53	51	53
	All	51	53	51	53	51	53

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-270. Differences[a] between ESO Scenarios and HOS and LOS Scenarios in Mean Monthly Water Temperature (°F) in the Stanislaus River at Orange Blossom Bridge

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	-0.03 (-0.1%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jun	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	-0.2 (-0.3%)	0 (0%)	-0.1 (-0.1%)
	All	0 (0%)	-0.04 (-0.1%)	0 (0%)	0 (0%)
Jul	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0.3 (0.4%)	0.1 (0.1%)	0 (0%)
	All	0 (0%)	0.1 (0.1%)	0 (0%)	0 (0%)
Aug	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	-0.3 (-0.4%)	0 (0%)	0 (0%)	0 (0%)
	All	-0.1 (-0.1%)	0 (0%)	0 (0%)	0 (0%)
Sep	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	-0.2 (-0.3%)	0.1 (0.2%)	0 (0%)	0 (0%)
	All	-0.04 (-0.1%)	0 (0%)	0 (0%)	0 (0%)
Oct	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0.1 (0.2%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	-0.05 (-0.1%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	W	0 (0%)	-0.1 (-0.1%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)

[a] Negative values indicate lower water temperatures under HOS or LOS than under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

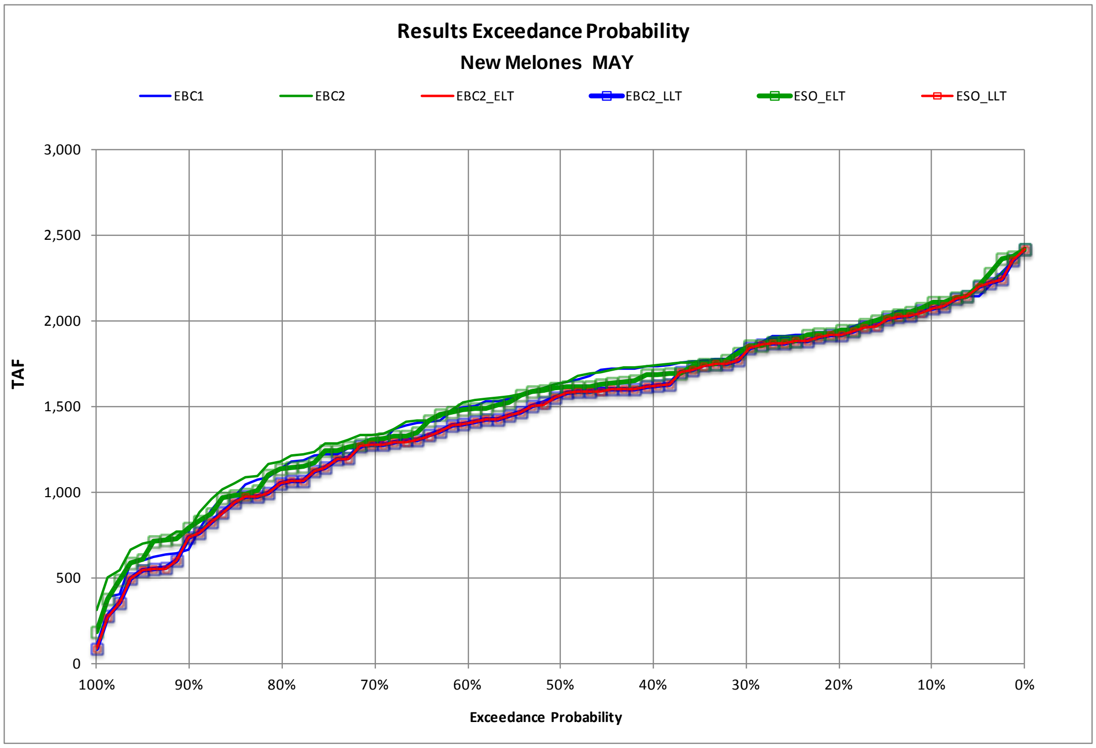
Coldwater pool availability is determined, to a large extent, by the volume of water in reservoir storage. The volume of reservoir storage in the spring (May) and fall (September) has been used here as an indicator of changes in reservoir storage between EBC and ESO scenarios (Table 5C.5.2-271). The frequency of exceedance analyses for New Melones Reservoir storage in May and September are shown in Figure 5C.5.2-193 and Figure 5C.5.2-194, respectively. Differences between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT are presented in Table 5C.5.2-272. These results indicate that New Melones Reservoir storage and, therefore, coldwater pool volume would be nearly identical between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. Further, reservoir storage would not differ between the ESO scenario and HOS and LOS scenarios (Table 5C.5.2-273, Table 5C.5.2-274). Therefore, ESO, HOS, and LOS scenarios are not expected to affect coldwater pool availability and the ability to meet downstream water temperature conditions for steelhead in the Stanislaus River.

Overall, these results indicate that there would be no effects of ESO, HOS, or LOS scenarios on water temperatures in the Stanislaus River. Given these results, it was concluded that there would be no water temperature-related effects of ESO, HOS, or LOS scenarios on steelhead spawning and egg incubation in the Stanislaus River. Therefore, no further temperature-related biological analyses on steelhead spawning and egg incubation are provided.

Table 5C.5.2-271. May and September Water Storage (Thousand Acre-Feet) in New Melones Reservoir under EBC and ESO Scenarios

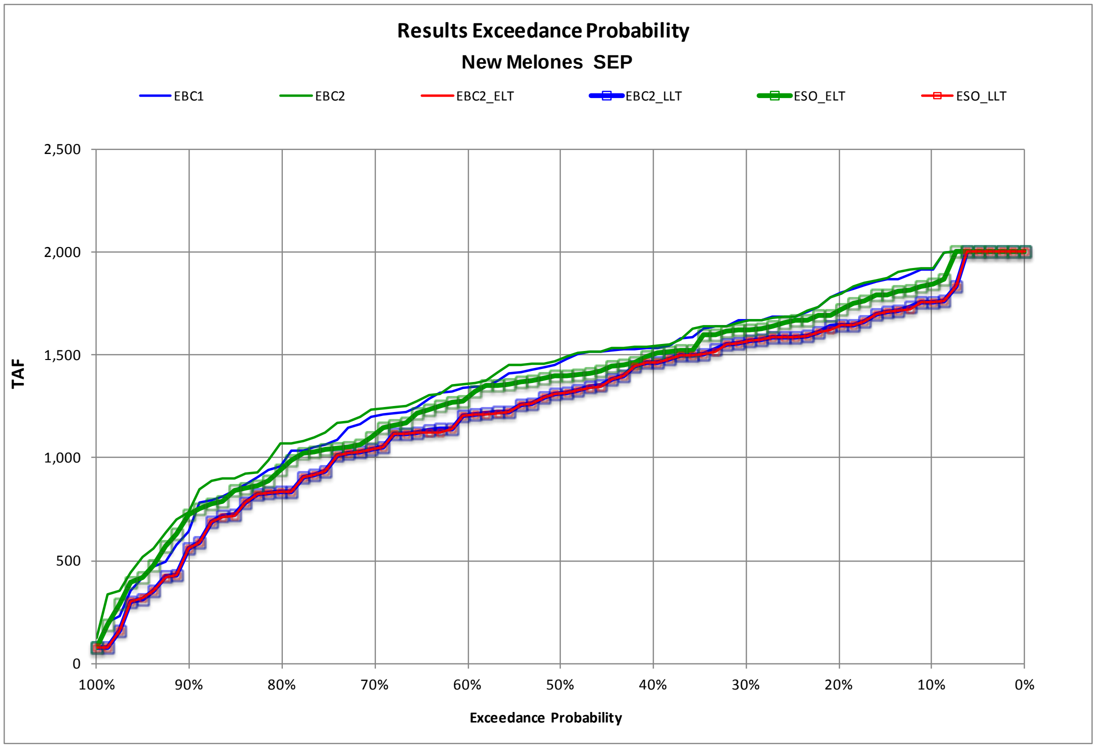
Water-Year Type	Scenario[a]					
	EBC1	**EBC2**	**EBC2_ELT**	**EBC2_LLT**	**ESO_ELT**	**ESO_LLT**
May						
Wet	1,932	1,941	1,948	1,917	1,948	1,916
Above Normal	1,638	1,650	1,641	1,623	1,641	1,622
Below Normal	1,476	1,509	1,458	1,394	1,458	1,393
Dry	1,375	1,394	1,334	1,287	1,334	1,286
Critical	820	894	821	711	821	710
September						
Wet	1,787	1,797	1,749	1,677	1,750	1,676
Above Normal	1,484	1,504	1,444	1,366	1,444	1,364
Below Normal	1,314	1,354	1,272	1,180	1,272	1,179
Dry	1,190	1,219	1,130	1,066	1,130	1,066
Critical	647	718	642	537	642	536

[a] See Table 5C.0-1 for definitions of the scenarios.



Note: TAF = thousand acre-feet.

Figure 5C.5.2-193. Probability of Exceedance Plot for EBC and ESO Scenarios of New Melones Reservoir Water Storage Volume, May



Note: TAF = thousand acre-feet.

Figure 5C.5.2-194. Probability of Exceedance Plot for EBC andESO Scenarios of New Melones Reservoir Water Storage Volume, September

Table 5C.5.2-272. Differences[a] between EBC and ESO Scenarios in May and September Water Storage (Thousand Acre-Feet) in New Melones Reservoir

Water-Year Type	Scenario[b]	
	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
May		
Wet	0 (0%)	-1 (-0.1%)
Above Normal	0 (0%)	-2 (-0.1%)
Below Normal	0 (0%)	-1 (-0.1%)
Dry	0 (0%)	0 (0%)
Critical	0 (0%)	-2 (-0.2%)
All	0 (0%)	-1 (-0.1%)
September		
Wet	0 (0%)	-1 (0%)
Above Normal	0 (0%)	-2 (-0.1%)
Below Normal	0 (0%)	-1 (-0.1%)
Dry	0 (0%)	0 (0%)
Critical	0 (0%)	-1 (-0.3%)
All	0 (0%)	-1 (-0.1%)

[a] Negative values indicate less water storage under ESO.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-273. May and September Water Storage (Thousand Acre-Feet) in New Melones Reservoir for ESO, HOS, and LOS Scenarios

Water-Year Type	Scenario[a]					
	ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
May						
Wet	1,948	1,916	1,948	1,919	1,948	1,916
Above Normal	1,641	1,622	1,641	1,625	1,641	1,621
Below Normal	1,458	1,393	1,460	1,395	1,459	1,393
Dry	1,334	1,286	1,334	1,287	1,334	1,286
Critical	821	710	822	715	821	710
All	1,520	1,469	1,520	1,471	1,520	1,469
September						
Wet	1,750	1,676	1,750	1,678	1,750	1,676
Above Normal	1,444	1,364	1,444	1,367	1,444	1,364
Below Normal	1,272	1,179	1,274	1,182	1,273	1,179
Dry	1,130	1,066	1,130	1,067	1,130	1,066
Critical	642	536	643	541	641	536
All	1,325	1,245	1,326	1,247	1,325	1,245

[a] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-274. Differences[a] between ESO Scenarios and HOS and LOS Scenarios in May and September Water Storage (Thousand Acre-Feet) in New Melones Reservoir

Water-Year Type	Scenarios[b]			
	ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
May				
Wet	0 (0%)	2 (0.1%)	0 (0%)	0 (0%)
Above Normal	1 (0.04%)	3 (0.2%)	0 (0%)	0 (0%)
Below Normal	1 (0.1%)	3 (0.2%)	0 (0%)	0 (0%)
Dry	0 (0%)	1 (0.1%)	0 (0%)	0 (0%)
Critical	1 (0.1%)	5 (0.7%)	-0.5 (-0.1%)	0 (0%)
All	1 (0.04%)	3 (0.2%)	0 (0%)	0 (0%)
September				
Wet	0 (0%)	2 (0.1%)	0 (0%)	0 (0%)
Above Normal	0.51 (0%)	3 (0.2%)	0 (0%)	0 (0%)
Below Normal	1 (0.1%)	3 (0.2%)	0 (0%)	0 (0%)
Dry	0 (0%)	1 (0.1%)	0 (0%)	0 (0%)
Critical	2 (0.2%)	5 (1%)	-0.4 (-0.1%)	0 (0%)
All	1 (0.05%)	2 (0.2%)	0 (0%)	0 (0%)

[a] Positive values indicate greater water storage under HOS or LOS.
[b] See Table 5C.0-1 for definitions of the scenarios.

Redd Dewatering

Ramping rates for releases on the Stanislaus River are included as part of routine operations and would be expected to remain the same in the future under the ESO. Flows in the river are maintained to avoid redd dewatering. Monthly CALSIM modeling predicts that flows under EBC2_ELT and EBC2_LLT during the primary steelhead spawning and egg incubation period (January and April) would be similar to flows under ESO_ELT and ESO_LLT, indicating that the ESO would not affect the risk of redd dewatering (Table 5C.5.2-263, Table 5C.5.2-264, Figure 5C.5.2-181 through Figure 5C.5.2-184). Further, flows under HOS and LOS scenarios would be similar to flows under ESO, indicating that HOS and LOS would not affect the risk of redd dewatering (Table 5C.5.2-265, Table 5C.5.2-266).

5C.5.2.7.1.2 Fry and Juvenile Rearing

Rearing Habitat

Juvenile steelhead rear in freshwater for a year or more and are, therefore, dependent on suitable freshwater rearing conditions during all months of the year. Information on steelhead abundance on the Stanislaus River is limited and has generally been collected opportunistically with existing Chinook salmon monitoring protocols. The juvenile life stage occurs throughout the entire river, with the majority of rearing occurring between Goodwin Dam and Oakdale. Resident rainbow trout are abundant from Goodwin Dam down through the Lover's Leap area. Rotary screw traps at Oakdale and Caswell catch downstream migrating steelhead with smolting characteristics each year. The Stanislaus River weir has captured a few adult steelhead. Three of these steelhead captured at the weir were positively identified as steelhead based on scale samples. Of the three major San Joaquin tributaries, the Stanislaus River receives the highest year-round flows during most years and has the coolest water. A large population of resident trout in the roughly 10 river miles below Goodwin Dam indicates favorable year-round habitat conditions for juvenile steelhead rearing in this reach. Snorkel surveys (Kennedy and Cannon 2002) identified trout fry starting in April 2000 and 2001, with the first fry observed in upstream areas each year. During 2003, a few trout fry were identified as early as January but most did not appear until April as in 2000 and 2001.

The two primary potential effects of BDCP operations on habitat conditions for fry and juvenile steelhead rearing in the Stanislaus River relate to changes in either instream flows or seasonal water temperatures released from New Melones Dam. Predicted instream flows in the Stanislaus River at the confluence with the San Joaquin River are presented in Table 5C.5.2-263 and differences between pairs of model scenarios are presented in Table 5C.5.2-264. Monthly frequency of exceedance plots for all months are presented in Figure 5C.5.2-181 through Figure 5C.5.2-192. These results indicate that instream flows would be nearly identical between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT for all months and water-year types. Further, flows under HOS and LOS scenarios would be similar to flows under ESO (Table 5C.5.2-265, Table 5C.5.2-266). Therefore, there would be no flow-related effects of ESO, HOS, or LOS scenarios on fry and juvenile steelhead rearing in the Stanislaus River.

Results of water temperature simulation analyses for the Stanislaus River at Orange Blossom Bridge were used to determine whether there would be temperature-related effects of the ESO on steelhead rearing. Predicted average water temperatures by month and water-year type for the Stanislaus River at Orange Blossom Bridge are presented in Table 5C.5.2-267 and differences between model scenarios are presented in Table 5C.5.2-268. These results indicate that there would be no differences in mean monthly water temperatures between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. Further there would be no differences in mean monthly water temperatures year-round at Orange Blossom Bridge between the ESO scenarios and HOS and LOS scenarios (Table 5C.5.2-269, Table 5C.5.2-270).

Based on the similarity between model scenarios of instream flows and water temperatures in the Stanislaus River, it is concluded that there would be no effects of ESO, HOS or LOS scenarios on rearing fry and juvenile steelhead in the Stanislaus River.

5C.5.2.7.1.3 Adult

Water Temperature

Results of the Reclamation Temperature Model for the steelhead migration period (October through December) in the Stanislaus River at Orange Blossom Bridge by month and water-year type are presented in Table 5C.5.2-267 and differences between model scenarios are presented in Table 5C.5.2-268. These results indicate that there would be no differences in mean monthly water temperatures between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. Further there would be no differences in mean monthly water temperatures year-round at Orange Blossom Bridge between the ESO scenarios and HOS and LOS scenarios (Table 5C.5.2-269, Table 5C.5.2-270). Based on these results, it was concluded that ESO, HOS, and LOS scenarios would not affect the suitability of instream habitat conditions for adult steelhead migration.

5C.5.2.7.2 Fall-Run/Late Fall–Run

5C.5.2.7.2.1 Eggs and Alevins

Upstream Spawning Habitat

Fall-run Chinook salmon migrate upstream from the mainstem San Joaquin River to spawn in the Stanislaus River during September and October. Spawning and egg incubation occurs during October through January. Mean monthly Stanislaus River flows by month and water-year type at the confluence with the lower San Joaquin River are predicted to be similar between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT during the primary Chinook salmon spawning and incubation period (October through January) (Table 5C.5.2-263, Table 5C.5.2-264. Figure 5C.5.2-181, and Figure 5C.5.2-190 through Figure 5C.5.2-192). Further, flows under HOS and LOS scenarios would generally be similar to flows under ESO during the spawning and egg incubation period (Table 5C.5.2-265, Table 5C.5.2-266. Based on these results, it was concluded that ESO, HOS, and LOS scenarios would not affect flow-related habitat conditions for fall-run Chinook salmon spawning and incubation in the Stanislaus River.

Water Temperature

Fall-run salmon spawn and eggs incubate in the Stanislaus River primarily during the late fall and early winter (October through January) when seasonal air temperatures are declining. Water temperatures in the Stanislaus River at Orange Blossom Bridge are presented by month and water-year type Table 5C.5.2-267 and differences between model scenarios are presented in Table 5C.5.2-268. These results indicate that there would be no differences in mean monthly water temperatures between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT regardless of month or water-year type. Further there would be no differences in mean monthly water temperatures at Orange Blossom Bridge between the ESO scenarios and HOS and LOS scenarios during October through January (Table 5C.5.2-269, Table 5C.5.2-270). Therefore, it is concluded that there are no temperature-related effects of ESO, HOS, and LOS scenarios predicted on fall-run spawning and egg incubation habitat.

The Reclamation egg mortality model was used to predict the effect of the ESO on fall-run egg survival. Results are summarized in Table 5C.5.2-275. The model predicts that fall-run egg mortality in the Stanislaus River is nearly identical between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT regardless of water-year type. Due to similarities in flows between the ESO scenario and HOS and LOS scenarios in the Stanislaus River at the confluence with the San Joaquin River (Table 5C.5.2-265, Table 5C.5.2-266, the egg mortality model was not run on HOS and LOS scenarios.

Table 5C.5.2-275. Egg Mortality Percentages for Fall-Run Chinook in the Stanislaus River under EBC and ESO Scenarios

Water-Year Type	Scenario[a]					
	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Wet	4.4	4.3	7.8	14.9	7.8	14.9
Above Normal	3.3	3.2	5.8	11.4	5.8	11.4
Below Normal	5.5	5.3	9.8	18.6	9.8	18.6
Dry	6.2	6.0	10.9	20.9	10.9	20.9
Critical	11.7	10.6	18.4	28.2	18.4	27.9
All	5.9	5.7	10.2	18.4	10.2	18.3

Source: Reclamation egg mortality model
[a] See Table 5C.0-1 for definitions of the scenarios.

Redd Dewatering

To evaluate the potential risk of redd dewatering for fall-run Chinook salmon within the Stanislaus River at the confluence with the San Joaquin River, it was assumed that fall-run Chinook salmon spawn in October and that the eggs and alevins incubate through January. Results of monthly CALSIM flows were used to determine the magnitude of flow reduction that would occur each month during the incubation period compared to the flow in October when spawning was assumed to occur. Redd dewatering risks would not occur for months when flows during the egg incubation period were at or greater than flows in the month when spawning occurred. The index of risk for redd dewatering is based on the greatest percentage change (reduction) in flows in any month during the egg incubation period when compared to the flows during the month spawning was assumed to occur. Results of the flow analyses for the risk of redd dewatering are summarized in Table 5C.5.2-276. Differences between pairs of modeling scenarios are presented in Table 5C.5.2-277. Results indicate that there would generally be no differences in the greatest monthly flow reductions between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. Based on these results, it was concluded that the ESO would not affect fall-run redd dewatering conditions in the Stanislaus River. Due to similarities in flows between the ESO scenario and HOS and LOS scenarios in the Stanislaus River at the confluence with the San Joaquin River (Table 5C.5.2-265, Table 5C.5.2-266), the redd dewatering analysis was not run on HOS and LOS scenarios.

Table 5C.5.2-276. Greatest Monthly Reduction (Percent Change) in Flow in the Stanislaus River at the Confluence with the San Joaquin River during the October through January Fall-Run Chinook Salmon Spawning and Egg Incubation Period under EBC and ESO Scenarios

Water-Year Type	Scenario[a, b]					
	EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Wet	-76	-76	-76	-76	-76	-76
Above Normal	-73	-74	-74	-74	-74	-74
Below Normal	-79	-79	-79	-79	-79	-79
Dry	-70	-70	-70	-70	-70	-70
Critical	-68	-68	-71	-71	-71	-71

[a] A negative value indicates a reduction in flows.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-277. Differences between EBC and ESO Scenarios in Greatest Monthly Reduction (Percentage Change) in Flow in the Stanislaus River at the Confluence with the San Joaquin River during the January through April Fall-Run Chinook Salmon Spawning and Egg Incubation Period

Water-Year Type	Scenarios[a, b]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Wet	1 (1%)	1 (1%)	1 (1%)	1 (1%)	0 (0%)	0 (0%)
Above Normal	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Below Normal	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dry	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Critical	-3 (-4%)	-3 (-4%)	-3 (-4%)	-3 (-4%)	0 (0%)	0 (0%)

[a] A negative value indicates that the greatest monthly reduction would be larger (worse) under the ESO than under the EBC.
[b] See Table 5C.0-1 for definitions of the scenarios.

5C.5.2.7.2.2 Fry and Juvenile Rearing

Rearing Habitat

Stanislaus River instream flows during the fall-run Chinook salmon rearing period (January through May) affect the value and availability of physical habitat for juvenile development and survival. CALSIM modeling of Stanislaus River flows over the January through May period are summarized in Table 5C.5.2-263 and differences between pairs of model scenarios are presented in Table 5C.5.2-264. Monthly frequency of exceedance plots for Stanislaus River flows for January through April are presented in Figure 5C.5.2-181 through Figure 5C.5.2-185. Results suggest that there would be no difference in instream flows between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. Further, flows under HOS and LOS scenarios would generally be similar to flows under ESO during the fall-run Chinook salmon rearing period (Table 5C.5.2-265, Table 5C.5.2-266). Based on these results, it was concluded that ESO, HOS, and LOS scenarios would not affect instream habitat conditions (e.g., water depths, velocities, wetted cross-sections) for juvenile fall-run Chinook salmon rearing within the Stanislaus River.

5C.5.2.7.2.3 Adult

Water Temperature

Adult fall-run Chinook salmon generally migrate upstream in the Stanislaus River during September and October prior to spawning. Results from the Reclamation Temperature Model in the Stanislaus River at Orange Blossom Bridge during September and October are presented in Table 5C.5.2-267 and differences between model scenarios are presented in Table 5C.5.2-268. There are negligible differences in mean monthly water temperature between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. Further there would be no differences in mean monthly water temperatures at Orange Blossom Bridge between the ESO scenarios and HOS and LOS scenarios during October through January (Table 5C.5.2-269, Table 5C.5.2-270). Therefore, it is concluded that ESO, HOS, and LOS scenarios would have no temperature-related effects on migration habitat conditions for adult fall-run Chinook salmon in the Stanislaus River.

5C.5.2.7.3 White Sturgeon

Due to uncertainties regarding white sturgeon presence in the San Joaquin River system, the analysis of effects on white sturgeon in the Stanislaus River was combined with the analysis in the mainstem San Joaquin River (Section 5C.5.2.6.5).

5C.5.2.7.4 Lamprey

5C.5.2.7.4.1 Eggs

Water Temperature

Exact spawning locations of Pacific and river lamprey in the Stanislaus River are not well known. Therefore, this analysis includes upstream (Knights Ferry) and downstream (Riverbank) locations that encompass the range in which those species are thought to spawn (Hannon pers. comm.). Pacific lamprey egg incubation in the Stanislaus River occurs between January and August; river lamprey egg incubation occurs between February and June. Mean monthly temperatures by month and water-year type for Knights Ferry and Riverbank are presented in Table 5C.5.2-278 and Table 5C.5.2-280, respectively. Differences between pairs of model scenarios for Knights Ferry and Riverbank are presented in Table 5C.5.2-279 and Table 5C.5.2-281, respectively. These results indicate that there would be negligible differences in mean monthly water temperatures between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT at both locations regardless of month or water-year type. Further, there would be no differences in January through August water temperatures between the ESO scenarios and HOS and LOS scenarios at either location (Table 5C.5.2-282 through Table 5C.5.2-285). Therefore, it is concluded that there are no temperature-related effects of ESO, HOS, or LOS scenarios predicted on Pacific lamprey eggs. As a result, no further temperature-related biological analyses on lamprey eggs are provided. Because this analysis uses water temperature model outputs based on CALSIM outputs, error has been propagated and the level of certainty of these results is moderate.

Table 5C.5.2-278. Mean Monthly Water Temperature (°F) in the Stanislaus River at Knights Ferry under EBC and ESO Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	49	48	50	52	50	52
	AN	49	49	50	52	50	52
	BN	49	49	50	52	50	52
	D	48	48	50	51	50	51
	C	49	49	50	52	50	52
	All	49	49	50	52	50	52
Feb	W	49	48	50	52	50	52
	AN	49	49	50	52	50	52
	BN	49	49	51	52	51	52
	D	49	49	50	52	50	52
	C	50	50	51	53	51	53
	All	49	49	50	52	50	52
Mar	W	49	49	50	52	50	52
	AN	49	49	51	53	51	53
	BN	51	51	52	54	52	54
	D	51	51	53	54	53	54
	C	52	52	54	55	54	55
	All	50	50	52	54	52	54
Apr	W	50	50	51	53	51	53
	AN	50	50	52	54	52	54
	BN	51	51	53	55	53	55
	D	52	52	53	55	53	55
	C	53	53	55	57	55	57
	All	51	51	53	54	53	54
May	W	51	51	53	55	53	55
	AN	53	53	54	56	54	56
	BN	54	54	56	57	56	57
	D	55	55	56	58	56	58
	C	56	56	58	59	58	59
	All	53	53	55	57	55	57
Jun	W	54	54	55	56	55	56
	AN	56	56	57	59	57	59
	BN	58	58	59	61	59	61
	D	59	59	61	63	61	63
	C	60	60	62	64	62	64
	All	57	57	58	60	58	60
Jul	W	57	57	58	59	58	59
	AN	59	59	61	62	61	62
	BN	60	60	62	63	62	63
	D	61	61	63	65	63	65
	C	62	62	64	66	64	66
	All	59	59	61	63	61	63

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Aug	W	58	58	59	61	59	61
	AN	60	60	61	63	61	63
	BN	60	60	62	64	62	64
	D	61	61	63	65	63	65
	C	62	62	65	67	65	67
	All	60	60	62	64	62	64
Sep	W	59	59	60	62	60	62
	AN	60	60	62	64	62	64
	BN	61	61	63	64	63	64
	D	62	62	63	65	63	65
	C	63	62	65	67	65	67
	All	61	61	62	64	62	64
Oct	W	59	59	61	62	61	62
	AN	59	59	61	62	61	62
	BN	59	59	60	62	60	62
	D	58	58	60	62	60	62
	C	60	60	62	64	62	64
	All	59	59	61	63	61	63
Nov	W	56	56	58	59	58	59
	AN	56	56	58	59	58	59
	BN	56	56	57	59	57	59
	D	56	56	57	59	57	59
	C	57	57	59	61	59	61
	All	56	56	58	60	58	60
Dec	W	52	52	53	55	53	55
	AN	52	52	53	55	53	55
	BN	51	51	53	54	53	54
	D	51	51	52	54	52	54
	C	52	52	53	55	53	55
	All	51	51	53	55	53	55

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-279. Differences[a] between EBC and ESO Scenarios in Mean Monthly Water Temperature (°F) in the Stanislaus River at Knights Ferry

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	1 (2.8%)	3 (6.3%)	1 (2.9%)	3 (6.4%)	0 (0%)	0 (0%)
	AN	1 (3%)	3 (6.4%)	1 (3%)	3 (6.4%)	0 (0%)	0 (0%)
	BN	1 (3%)	3 (6.4%)	1 (2.9%)	3 (6.4%)	0 (0%)	0 (0%)
	D	1 (3%)	3 (6.3%)	1 (2.9%)	3 (6.2%)	0 (0%)	0 (0%)
	C	1 (2.9%)	3 (6.2%)	2 (3.1%)	3 (6.5%)	0 (0%)	0 (0%)
	All	1 (2.9%)	3 (6.3%)	1 (3%)	3 (6.4%)	0 (0%)	0 (0%)
Feb	W	1 (2.6%)	3 (6.4%)	1 (2.8%)	3 (6.6%)	0 (0%)	0 (0%)
	AN	1 (3%)	3 (6.5%)	1 (3%)	3 (6.6%)	0 (0%)	0 (0%)
	BN	2 (3.1%)	3 (6.2%)	2 (3.1%)	3 (6.2%)	0 (0%)	0 (0%)
	D	2 (3.1%)	3 (6.5%)	1 (3%)	3 (6.4%)	0 (0%)	0 (0%)
	C	1 (3%)	3 (6.2%)	2 (3.2%)	3 (6.4%)	0 (0%)	0 (0%)
	All	1 (2.9%)	3 (6.4%)	1 (3%)	3 (6.5%)	0 (0%)	0 (0%)
Mar	W	1 (2.7%)	3 (6.6%)	1 (2.8%)	3 (6.6%)	0 (0%)	0 (0%)
	AN	2 (3.5%)	4 (7.3%)	2 (3.4%)	4 (7.3%)	0 (0%)	0 (0%)
	BN	1 (3%)	3 (6.1%)	1.5 (3%)	3 (6.2%)	0 (0%)	0 (0%)
	D	1.6 (3.2%)	3 (6.5%)	2 (3.2%)	3 (6.5%)	0 (0%)	0 (0%)
	C	1 (2.7%)	3 (5.8%)	1 (2.7%)	3 (5.9%)	0 (0%)	0 (0%)
	All	1 (3%)	3 (6.5%)	2 (3%)	3 (6.5%)	0 (0%)	0 (0%)
Apr	W	1 (2.9%)	3 (6.2%)	1 (2.9%)	3 (6.2%)	0 (0%)	0 (0%)
	AN	2 (3.2%)	3 (6.6%)	2 (3.1%)	3 (6.4%)	0 (0%)	0 (0%)
	BN	2 (3.3%)	3 (6.6%)	2 (3.3%)	3 (6.6%)	0 (0%)	0 (0%)
	D	2 (3.2%)	3 (6.7%)	2 (3.2%)	3 (6.7%)	0 (0%)	0 (0%)
	C	2 (3%)	4 (6.7%)	2 (3.1%)	4 (6.7%)	0 (0%)	0 (0%)
	All	2 (3.1%)	3 (6.5%)	2 (3.1%)	3 (6.5%)	0 (0%)	0 (0%)
May	W	2 (3%)	3 (5.9%)	1 (2.9%)	3 (5.8%)	0 (0%)	0 (0%)
	AN	2 (3%)	3 (5.9%)	2 (2.9%)	3 (5.8%)	0 (0%)	0 (0%)
	BN	2 (3.5%)	4 (6.5%)	2 (3.4%)	3 (6.4%)	0 (0%)	0 (0%)
	D	2 (3.3%)	3 (6.2%)	2 (3.1%)	3 (6%)	0 (0%)	0 (0%)
	C	2 (3.3%)	3 (5.9%)	2 (3.4%)	3 (6%)	0 (0%)	0 (0%)
	All	2 (3.2%)	3 (6.1%)	2 (3.1%)	3 (6%)	0 (0%)	0 (0%)
Jun	W	1 (2.7%)	3 (4.8%)	1 (2.6%)	3 (4.7%)	0 (0%)	0 (0%)
	AN	2 (2.9%)	3 (6%)	2 (2.8%)	3 (5.9%)	0 (0%)	0 (0%)
	BN	2 (3.3%)	4 (6.3%)	2 (3.2%)	4 (6.2%)	0 (0%)	0 (0%)
	D	2.1 (3.5%)	4 (6.5%)	1.9 (3.2%)	4 (6.2%)	0 (0%)	0 (0%)
	C	2 (3.3%)	4 (7%)	2 (2.8%)	4 (6.5%)	0 (0%)	0 (0.1%)
	All	2 (3.1%)	3 (6%)	2 (2.9%)	3 (5.8%)	0 (0%)	0 (0%)
Jul	W	1 (2.6%)	3 (4.4%)	2 (2.6%)	3 (4.4%)	0 (0%)	0 (0%)
	AN	1.8 (3.1%)	3 (5.7%)	1.7 (2.9%)	3 (5.5%)	0 (0%)	0 (0%)
	BN	2 (3.2%)	4 (5.9%)	2 (2.9%)	3 (5.6%)	0 (0%)	0 (0%)
	D	2 (3.4%)	4 (6.1%)	2 (2.8%)	3 (5.5%)	0 (0%)	0 (0%)
	C	2 (3.3%)	4 (6.6%)	2 (3%)	4 (6.2%)	0 (0%)	0 (0%)
	All	2 (3.1%)	3 (5.6%)	2 (2.8%)	3 (5.4%)	0 (0%)	0 (0%)

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Aug	W	1.6 (2.8%)	3 (5.8%)	2 (2.8%)	3 (5.8%)	0 (0%)	0 (0%)
	AN	1.7 (2.9%)	3 (5.7%)	1.7 (2.9%)	3 (5.7%)	0 (0%)	0 (0%)
	BN	2 (2.9%)	3 (5.8%)	2 (2.8%)	3 (5.7%)	0 (0%)	0 (0%)
	D	2 (2.9%)	4 (5.8%)	2 (2.9%)	4 (5.8%)	0 (0%)	0 (0%)
	C	2 (3.7%)	4 (6.9%)	3 (4.4%)	5 (7.7%)	0 (0%)	0 (0%)
	All	2 (3%)	4 (6%)	2 (3.2%)	4 (6.2%)	0 (0%)	0 (0%)
Sep	W	2 (2.7%)	4 (6%)	2 (2.7%)	3 (5.9%)	0 (0%)	0 (0%)
	AN	2 (2.8%)	4 (6%)	2 (2.9%)	4 (6.1%)	0 (0%)	0 (0%)
	BN	2 (2.8%)	4 (5.9%)	2 (2.8%)	4 (5.8%)	0 (0%)	0 (0%)
	D	2 (2.9%)	4 (6%)	2 (2.9%)	4 (6%)	0 (0%)	0 (0%)
	C	2 (3.3%)	4 (6.3%)	3 (4.3%)	5 (7.3%)	0 (0%)	0.1 (0.1%)
	All	2 (2.9%)	4 (6%)	2 (3.1%)	4 (6.2%)	0 (0%)	0 (0%)
Oct	W	2 (2.7%)	3 (5.9%)	2 (3%)	4 (6.2%)	0 (0%)	0 (0%)
	AN	1 (2.4%)	3 (5.1%)	1.7 (2.8%)	3 (5.5%)	0 (0%)	0 (0%)
	BN	2 (2.7%)	3 (5.6%)	2 (2.7%)	3 (5.6%)	0 (0%)	0 (0%)
	D	2 (2.8%)	3 (5.9%)	2 (2.8%)	3 (5.9%)	0 (0%)	0 (0%)
	C	2 (2.8%)	4 (6.1%)	2 (3.3%)	4 (6.6%)	0 (0%)	0 (0%)
	All	2 (2.7%)	3 (5.7%)	2 (2.9%)	4 (6%)	0 (0%)	0 (0%)
Nov	W	1 (2.6%)	3 (5.8%)	2 (2.8%)	3 (6%)	0 (0%)	0 (0%)
	AN	1 (2.5%)	3 (5.5%)	2 (2.8%)	3 (5.7%)	0 (0%)	0 (0%)
	BN	1 (2.6%)	3 (5.8%)	2 (2.7%)	3 (5.9%)	0 (0%)	0 (0%)
	D	1 (2.6%)	3 (6%)	1 (2.7%)	3 (6.1%)	0 (0%)	0 (0%)
	C	2 (2.7%)	3 (6.1%)	2 (3%)	4 (6.4%)	0 (0%)	0 (0%)
	All	1 (2.6%)	3 (5.8%)	2 (2.8%)	3 (6%)	0 (0%)	0 (0%)
Dec	W	1 (2.7%)	3 (6.5%)	1 (2.8%)	3 (6.6%)	0 (0%)	0 (0%)
	AN	1 (2.7%)	3 (5.9%)	1 (2.7%)	3 (6%)	0 (0%)	0 (0%)
	BN	1 (2.8%)	3 (6.4%)	1 (2.8%)	3 (6.4%)	0 (0%)	0 (0%)
	D	1.4 (2.7%)	3 (6.2%)	1 (2.7%)	3 (6.2%)	0 (0%)	0 (0%)
	C	1 (2.8%)	3 (6.4%)	1 (2.9%)	3 (6.5%)	0 (0%)	0 (0%)
	All	1 (2.7%)	3 (6.3%)	1 (2.8%)	3 (6.4%)	0 (0%)	0 (0%)

[a] Positive values indicate higher water temperature under ESO than under EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-280. Mean Monthly Water Temperature (°F) in the Stanislaus River at Riverbank under EBC and ESO Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Jan	W	47	47	48	50	48	50
	AN	47	47	48	49	48	49
	BN	46	46	48	49	48	49
	D	45	45	47	48	47	48
	C	46	46	47	49	47	49
	All	46	46	48	49	48	49
Feb	W	49	49	51	52	51	52
	AN	50	50	51	53	51	53
	BN	50	50	51	52	51	52
	D	50	50	51	53	51	53
	C	51	51	52	54	52	54
	All	50	50	51	53	51	53
Mar	W	51	51	52	54	52	54
	AN	52	51	53	55	53	55
	BN	53	53	55	56	55	56
	D	54	54	56	57	56	57
	C	54	54	55	57	55	57
	All	52	53	54	56	54	56
Apr	W	52	52	53	55	53	55
	AN	53	53	55	56	55	56
	BN	54	54	56	57	56	57
	D	54	54	56	58	56	58
	C	57	57	58	60	58	60
	All	54	54	55	57	55	57
May	W	56	56	57	59	57	59
	AN	57	57	59	60	59	60
	BN	58	58	60	62	60	62
	D	59	59	61	62	61	62
	C	60	60	62	64	62	64
	All	58	58	59	61	59	61
Jun	W	60	60	61	62	61	62
	AN	62	62	64	66	64	66
	BN	64	64	66	68	66	68
	D	66	67	69	70	69	70
	C	66	67	68	70	68	70
	All	63	63	65	67	65	67
Jul	W	65	65	67	67	67	67
	AN	68	68	70	71	70	71
	BN	68	68	70	71	70	71
	D	68	69	70	72	70	72
	C	68	68	70	72	70	72
	All	67	67	69	70	69	70

Month	Water-Year Type[a]	Scenario[b]					
		EBC1	EBC2	EBC2_ELT	EBC2_LLT	ESO_ELT	ESO_LLT
Aug	W	65	65	67	69	67	69
	AN	67	67	69	70	69	70
	BN	67	67	68	70	68	70
	D	68	68	69	71	69	71
	C	67	67	69	71	69	71
	All	66	66	68	70	68	70
Sep	W	64	64	65	67	65	67
	AN	66	66	68	70	68	70
	BN	66	66	67	69	67	69
	D	66	66	68	70	68	70
	C	66	66	68	70	68	70
	All	65	65	67	69	67	69
Oct	W	59	59	61	63	61	63
	AN	59	59	61	62	61	62
	BN	59	59	60	62	60	62
	D	59	59	60	62	60	62
	C	61	61	62	64	62	64
	All	60	60	61	63	61	63
Nov	W	53	53	55	56	55	56
	AN	53	53	54	56	54	56
	BN	53	53	54	56	54	56
	D	53	53	54	56	54	56
	C	54	54	55	57	55	57
	All	53	53	54	56	54	56
Dec	W	48	48	49	51	49	51
	AN	48	48	49	50	49	50
	BN	47	47	48	50	48	50
	D	47	47	48	50	48	50
	C	47	47	48	50	48	50
	All	47	47	49	50	49	50

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-281. Differences[a] between EBC and ESO Scenarios in Mean Monthly Water Temperature (°F) in the Stanislaus River at Riverbank

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Jan	W	1 (2.8%)	3 (6.3%)	1 (2.9%)	3 (6.3%)	0 (0%)	0 (0%)
	AN	1 (3.1%)	3 (6.4%)	1 (3%)	3 (6.4%)	0 (0%)	0 (0%)
	BN	1 (2.7%)	3 (6%)	1 (2.7%)	3 (6%)	0 (0%)	0 (0%)
	D	1 (2.7%)	3 (5.6%)	1 (2.7%)	3 (5.6%)	0 (0%)	0 (0%)
	C	1 (2.6%)	3 (5.8%)	1 (3%)	3 (6.2%)	0 (0%)	0 (0%)
	All	1 (2.8%)	3 (6%)	1 (2.9%)	3 (6.1%)	0 (0%)	0 (0%)
Feb	W	1 (2.5%)	3 (5.9%)	1 (2.5%)	3 (6%)	0 (0%)	0 (0%)
	AN	1 (2.8%)	3 (5.8%)	1 (2.8%)	3 (5.8%)	0 (0%)	0 (0%)
	BN	2 (3.1%)	3 (5.5%)	2 (3%)	3 (5.4%)	0 (0%)	0 (0%)
	D	2 (3.3%)	3 (6.1%)	2 (3.2%)	3 (5.9%)	0 (0%)	0 (0%)
	C	2 (3.1%)	3 (6%)	1 (2.9%)	3 (5.8%)	0 (0%)	0 (0%)
	All	1 (2.9%)	3 (5.9%)	1 (2.8%)	3 (5.8%)	0 (0%)	0 (0%)
Mar	W	1 (2.1%)	3 (5.9%)	1 (2.1%)	3 (6%)	0 (0%)	0 (0%)
	AN	2 (3.3%)	4 (7%)	2 (3.4%)	4 (7%)	0 (0%)	0 (0%)
	BN	1 (2.5%)	3 (5.3%)	1.3 (2.5%)	3 (5.3%)	0 (0%)	0 (0%)
	D	1.7 (3.2%)	3 (6.4%)	2 (3%)	3 (6.2%)	0 (0%)	0 (0%)
	C	1 (2.6%)	3 (5.6%)	1 (2.1%)	3 (5.1%)	0 (0%)	0 (0%)
	All	1 (2.7%)	3 (6%)	1 (2.6%)	3 (5.9%)	0 (0%)	0 (0%)
Apr	W	1 (2.7%)	3 (5.7%)	1 (2.6%)	3 (5.7%)	0 (0%)	0 (0%)
	AN	2 (2.9%)	3 (6.1%)	2 (2.9%)	3 (6%)	0 (0%)	0 (0%)
	BN	2 (3.4%)	4 (6.6%)	2 (3.3%)	4 (6.5%)	0 (0%)	0 (0%)
	D	2 (3.2%)	4 (6.7%)	2 (3%)	4 (6.6%)	0 (0%)	0 (0%)
	C	2 (3%)	4 (6.3%)	2 (2.9%)	3 (6.2%)	0 (0%)	0 (0%)
	All	2 (3%)	3 (6.2%)	2 (2.9%)	3 (6.1%)	0 (0%)	0 (0%)
May	W	2 (3%)	3 (5.8%)	2 (3%)	3 (5.8%)	0 (0%)	0 (0%)
	AN	2 (3.3%)	3 (6%)	2 (3.3%)	3 (5.9%)	0 (0%)	0 (0%)
	BN	2 (4.2%)	4 (7.4%)	2 (4.1%)	4 (7.4%)	0 (0%)	0 (0%)
	D	2 (3.6%)	4 (6.6%)	2 (3.3%)	4 (6.3%)	0 (0%)	0 (0%)
	C	2 (3.3%)	3 (5.8%)	2 (3.1%)	3 (5.5%)	0 (0%)	0 (0%)
	All	2 (3.4%)	4 (6.2%)	2 (3.3%)	4 (6.1%)	0 (0%)	0 (0%)
Jun	W	1 (2%)	2 (3.4%)	1 (2%)	2 (3.4%)	0 (0%)	0 (0%)
	AN	2 (3%)	4 (6.4%)	2 (3%)	4 (6.4%)	0 (0%)	0 (0%)
	BN	2 (3.1%)	4 (5.7%)	2 (3%)	4 (5.7%)	0 (0%)	0 (0%)
	D	2.3 (3.5%)	4 (6.1%)	2 (3%)	4 (5.5%)	0 (0%)	0 (0%)
	C	2 (3.1%)	4 (5.6%)	2 (2.6%)	3 (5.1%)	0 (0%)	0.1 (0.1%)
	All	2 (2.8%)	3 (5.2%)	2 (2.6%)	3 (5%)	0 (0%)	0 (0%)
Jul	W	1 (2.1%)	2 (2.8%)	2 (2.4%)	2 (3.1%)	0 (0%)	0 (0%)
	AN	2 (2.9%)	3 (4.8%)	1.9 (2.8%)	3 (4.7%)	0 (0%)	0 (0%)
	BN	2 (2.7%)	3 (4.6%)	2 (2.4%)	3 (4.2%)	0 (0%)	0 (0%)
	D	2 (3.2%)	4 (5.3%)	2 (2.2%)	3 (4.3%)	0 (0%)	0 (0%)
	C	2 (2.9%)	4 (5.1%)	2 (2.7%)	3 (4.9%)	0 (0%)	0 (0%)
	All	2 (2.7%)	3 (4.3%)	2 (2.5%)	3 (4.2%)	0 (0%)	0 (0%)

Month	Water-Year Type[b]	Scenarios[c]					
		EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
Aug	W	1.8 (2.8%)	4 (6.4%)	2 (2.9%)	4 (6.4%)	0 (0%)	0 (0%)
	AN	1.8 (2.7%)	3 (5.1%)	1.8 (2.7%)	3 (5.1%)	0 (0%)	0 (0%)
	BN	2 (2.5%)	3 (4.8%)	2 (2.4%)	3 (4.8%)	0 (0%)	0 (0%)
	D	2 (2.4%)	3 (4.9%)	2 (2.5%)	3 (4.9%)	0 (0%)	0 (0%)
	C	2 (3.1%)	4 (5.6%)	2 (3%)	4 (5.6%)	0 (0%)	0 (0%)
	All	2 (2.7%)	4 (5.5%)	2 (2.7%)	4 (5.5%)	0 (0%)	0 (0%)
Sep	W	2 (2.7%)	4 (6.2%)	2 (2.6%)	4 (6.1%)	0 (0%)	0 (0%)
	AN	2 (2.9%)	4 (5.9%)	2 (2.9%)	4 (5.9%)	0 (0%)	0 (0%)
	BN	2 (2.7%)	4 (5.7%)	2 (2.7%)	4 (5.7%)	0 (0%)	0 (0%)
	D	2 (2.7%)	4 (5.6%)	2 (2.7%)	4 (5.6%)	0 (0%)	0 (0%)
	C	2 (2.9%)	4 (5.5%)	2 (3.2%)	4 (5.8%)	0 (0%)	-0.2 (-0.2%)
	All	2 (2.8%)	4 (5.8%)	2 (2.8%)	4 (5.9%)	0 (0%)	0 (0%)
Oct	W	1 (2.4%)	3 (5.3%)	1 (2.5%)	3 (5.3%)	0 (0%)	0 (0%)
	AN	1 (2.2%)	3 (4.9%)	1.3 (2.2%)	3 (4.9%)	0 (0%)	0 (0%)
	BN	1 (2.1%)	3 (4.9%)	1 (2.1%)	3 (4.9%)	0 (0%)	0 (0%)
	D	1 (2.3%)	3 (5.2%)	1 (2.3%)	3 (5.2%)	0 (0%)	0 (0%)
	C	2 (2.5%)	3 (5.5%)	2 (2.6%)	3 (5.6%)	0 (0%)	0 (0%)
	All	1 (2.3%)	3 (5.2%)	1 (2.4%)	3 (5.2%)	0 (0%)	0 (0%)
Nov	W	1 (2.4%)	3 (5.7%)	1 (2.4%)	3 (5.7%)	0 (0%)	0 (0%)
	AN	1 (2.3%)	3 (5.9%)	1 (2.4%)	3 (6%)	0 (0%)	0 (0%)
	BN	1 (2.3%)	3 (5.8%)	1 (2.4%)	3 (5.9%)	0 (0%)	0 (0%)
	D	1 (2.2%)	3 (5.8%)	1 (2.3%)	3 (5.8%)	0 (0%)	0 (0%)
	C	1 (2.3%)	3 (5.6%)	1 (2.4%)	3 (5.7%)	0 (0%)	0 (0%)
	All	1 (2.3%)	3 (5.7%)	1 (2.4%)	3 (5.8%)	0 (0%)	0 (0%)
Dec	W	1 (2.7%)	3 (6.5%)	1 (2.8%)	3 (6.6%)	0 (0%)	0 (0%)
	AN	1 (2.5%)	3 (6.1%)	1 (2.5%)	3 (6.1%)	0 (0%)	0 (0%)
	BN	1 (2.6%)	3 (7%)	1 (2.6%)	3 (7%)	0 (0%)	0 (0%)
	D	1.1 (2.3%)	3 (5.9%)	1 (2.3%)	3 (6%)	0 (0%)	0 (0%)
	C	1 (2.4%)	3 (6.2%)	1 (2.4%)	3 (6.2%)	0 (0%)	0 (0%)
	All	1 (2.5%)	3 (6.4%)	1 (2.6%)	3 (6.4%)	0 (0%)	0 (0%)

[a] Positive values indicate higher water temperature under ESO than under EBC.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-282. Mean Monthly Water Temperature (°F) in the Stanislaus River at Knights Ferry for ESO, HOS, and LOS Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	50	52	50	52	50	52
	AN	50	52	50	52	50	52
	BN	50	52	50	52	50	52
	D	50	51	50	51	50	51
	C	50	52	50	52	50	52
	All	50	52	50	52	50	52
Feb	W	50	52	50	52	50	52
	AN	50	52	50	52	50	52
	BN	51	52	51	52	51	52
	D	50	52	50	52	50	52
	C	51	53	51	53	51	53
	All	50	52	50	52	50	52
Mar	W	50	52	50	52	50	52
	AN	51	53	51	53	51	53
	BN	52	54	52	54	52	54
	D	53	54	53	54	53	54
	C	54	55	54	55	54	55
	All	52	54	52	54	52	54
Apr	W	51	53	51	53	51	53
	AN	52	54	52	54	52	54
	BN	53	55	53	55	53	55
	D	53	55	53	55	53	55
	C	55	57	55	57	55	57
	All	53	54	53	54	53	54
May	W	53	55	53	55	53	55
	AN	54	56	54	56	54	56
	BN	56	57	56	57	56	57
	D	56	58	56	58	56	58
	C	58	59	58	59	58	59
	All	55	57	55	57	55	57
Jun	W	55	56	55	56	55	56
	AN	57	59	57	59	57	59
	BN	59	61	59	61	59	61
	D	61	63	61	63	61	63
	C	62	64	62	64	62	64
	All	58	60	58	60	58	60
Jul	W	58	59	58	59	58	59
	AN	61	62	61	62	61	62
	BN	62	63	62	63	62	63
	D	63	65	63	65	63	65
	C	64	66	64	66	64	66
	All	61	63	61	63	61	63

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Aug	W	59	61	59	61	59	61
	AN	61	63	61	63	61	63
	BN	62	64	62	64	62	64
	D	63	65	63	65	63	65
	C	65	67	64	67	65	67
	All	62	64	62	64	62	64
Sep	W	60	62	60	62	60	62
	AN	62	64	62	64	62	64
	BN	63	64	63	64	63	64
	D	63	65	63	65	63	65
	C	65	67	65	67	65	67
	All	62	64	62	64	62	64
Oct	W	61	62	61	62	61	62
	AN	61	62	61	62	61	62
	BN	60	62	60	62	60	62
	D	60	62	60	62	60	62
	C	62	64	62	64	62	64
	All	61	63	61	63	61	63
Nov	W	58	59	58	59	58	59
	AN	58	59	58	59	58	59
	BN	57	59	57	59	57	59
	D	57	59	57	59	57	59
	C	59	61	59	61	59	61
	All	58	60	58	60	58	60
Dec	W	53	55	53	55	53	55
	AN	53	55	53	55	53	55
	BN	53	54	53	54	53	54
	D	52	54	52	54	52	54
	C	53	55	53	55	53	55
	All	53	55	53	55	53	55

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-283. Differences[a] between ESO Scenarios and HOS and LOS Scenarios in Mean Monthly Water Temperature (°F) in the Stanislaus River at Knights Ferry

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	-0.3 (-0.4%)	0 (0%)	-0.1 (-0.1%)
	All	0 (0%)	-0.1 (-0.1%)	0 (0%)	0 (0%)
Jul	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0.4 (0.6%)	0.1 (0.1%)	0 (0%)
	All	0 (0%)	0.1 (0.1%)	0 (0%)	0 (0%)

Month	Water-Year Type[b]	Scenarios[c] ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	-0.3 (-0.5%)	0 (0%)	0 (0%)	0 (0%)
	All	-0.1 (-0.1%)	0 (0%)	0 (0%)	0 (0%)
Sep	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	-0.2 (-0.3%)	0.2 (0.3%)	0 (0%)	0 (0%)
	All	-0.05 (-0.1%)	0 (0.1%)	0 (0%)	0 (0%)
Oct	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0.2 (0.3%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	-0.1 (-0.2%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	-0.04 (-0.1%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	-0.03 (-0.1%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)

[a] Positive values indicate higher water temperature under HOS or LOS than under ESO.
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-284. Mean Monthly Water Temperature (°F) in the Stanislaus River at Riverbank for ESO, HOS, and LOS Scenarios

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Jan	W	48	50	48	50	48	50
	AN	48	49	48	49	48	49
	BN	48	49	48	49	48	49
	D	47	48	47	48	47	48
	C	47	49	47	49	47	49
	All	48	49	48	49	48	49
Feb	W	51	52	51	52	51	52
	AN	51	53	51	53	51	53
	BN	51	52	51	52	51	52
	D	51	53	51	53	51	53
	C	52	54	52	54	52	54
	All	51	53	51	53	51	53
Mar	W	52	54	52	54	52	54
	AN	53	55	53	55	53	55
	BN	55	56	55	56	55	56
	D	56	57	56	57	56	57
	C	55	57	55	57	55	57
	All	54	56	54	56	54	56
Apr	W	53	55	53	55	53	55
	AN	55	56	55	56	55	56
	BN	56	57	56	57	56	57
	D	56	58	56	58	56	58
	C	58	60	58	60	58	60
	All	55	57	55	57	55	57
May	W	57	59	57	59	57	59
	AN	59	60	59	60	59	60
	BN	60	62	60	62	60	62
	D	61	62	61	62	61	62
	C	62	64	62	64	62	64
	All	59	61	59	61	59	61
Jun	W	61	62	61	62	61	62
	AN	64	66	64	66	64	66
	BN	66	68	66	68	66	68
	D	69	70	69	70	69	70
	C	68	70	68	70	68	70
	All	65	67	65	67	65	67
Jul	W	67	67	67	67	67	67
	AN	70	71	70	71	70	71
	BN	70	71	70	71	70	71
	D	70	72	70	72	70	72
	C	70	72	70	72	70	72
	All	69	70	69	70	69	70

Month	Water-Year Type[a]	Scenario[b]					
		ESO_ELT	ESO_LLT	HOS_ELT	HOS_LLT	LOS_ELT	LOS_LLT
Aug	W	67	69	67	69	67	69
	AN	69	70	69	70	69	70
	BN	68	70	68	70	68	70
	D	69	71	69	71	69	71
	C	69	71	69	71	69	71
	All	68	70	68	70	68	70
Sep	W	65	67	65	67	65	67
	AN	68	70	68	70	68	70
	BN	67	69	67	69	67	69
	D	68	70	68	70	68	70
	C	68	70	68	70	68	69
	All	67	69	67	69	67	69
Oct	W	61	63	61	63	61	63
	AN	61	62	61	62	61	62
	BN	60	62	60	62	60	62
	D	60	62	60	62	60	62
	C	62	64	62	64	62	64
	All	61	63	61	63	61	63
Nov	W	55	56	55	56	55	56
	AN	54	56	54	56	54	56
	BN	54	56	54	56	54	56
	D	54	56	54	56	54	56
	C	55	57	55	57	55	57
	All	54	56	54	56	54	56
Dec	W	49	51	49	51	49	51
	AN	49	50	49	50	49	50
	BN	48	50	48	50	48	50
	D	48	50	48	50	48	50
	C	48	50	48	50	48	50
	All	49	50	49	50	49	50

[a] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[b] See Table 5C.0-1 for definitions of the scenarios.

Table 5C.5.2-285. Differences[a] between ESO Scenarios and HOS and LOS Scenarios in Mean Monthly Water Temperature (°F) in the Stanislaus River at Riverbank

Month	Water-Year Type[b]	Scenarios[c]			
		ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Jan	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Feb	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mar	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Apr	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jun	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	-0.04 (-0.1%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Jul	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0.1 (0.2%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Month	Water-Year Type[b]	Scenarios[c] ESO_ELT vs. HOS_ELT	ESO_LLT vs. HOS_LLT	ESO_ELT vs. LOS_ELT	ESO_LLT vs. LOS_LLT
Aug	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	-0.2 (-0.4%)	0 (0%)	0 (0%)	0 (0%)
	All	-0.05 (-0.1%)	0 (0%)	0 (0%)	0 (0%)
Sep	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	-0.2 (-0.3%)	0 (0%)	0 (0%)	0 (0%)
	All	-0.04 (-0.1%)	0 (0%)	0 (0%)	0 (0%)
Oct	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0.03 (0.1%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nov	W	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dec	W	0 (0%)	-0.1 (-0.2%)	0 (0%)	0 (0%)
	AN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	BN	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	D	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	C	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	All	0 (0%)	-0.03 (-0.1%)	0 (0%)	0 (0%)

[a] Negative values indicate lower water temperature under HOS or LOS than under ESO>
[b] Water-year types: W = wet; AN = above normal; BN = below normal; D = dry; C = critical.
[c] See Table 5C.0-1 for definitions of the scenarios.

Redd Dewatering

To determine the effects of the ESO on redd dewatering risk to Pacific and river lamprey in the Stanislaus River, the number and frequency of redd "cohorts" experiencing a month-over-month (from one month to the next) decrease in flow of greater than 50%, which is assumed here to represent a redd dewatering event, at the confluence with the San Joaquin River was determined from CALSIM model outputs. Small-scale spawning location suitability characteristics (e.g., depth, velocity, and substrate) for lamprey are not adequately described to enable a more formal analysis, such as a weighted usable area analysis. Therefore, the change in month-over-month flows was used as a surrogate a month-over-month flow reduction of 50% was chosen as a best professional estimate of conditions in which redd dewatering is expected to occur, but this value does not estimate empirically-derived redd dewatering events. A "cohort" of eggs was assumed to be "born" every month during either January through August for Pacific lamprey or February through June for river lamprey. Due to similarities in flows in the Stanislaus River between the ESO scenario and HOS and LOS scenarios (Table 5C.5.2-265, Table 5C.5.2-266), this analysis was not conducted for HOS and LOS scenarios.

Results of the dewatering risk for Pacific lamprey are presented in Table 5C.5.2-91 and differences between pairs of model scenarios in redd dewatering risk are presented in Table 5C.5.2-92. The total number of redd cohorts that would experience a 50% month-over-month flow decrease would be nearly identical between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. These results indicate that there would be no effect of the ESO on Pacific lamprey redd dewatering in the Stanislaus River.

Results of the dewatering risk for river lamprey are presented in Table 5C.5.2-93 and differences between pairs of model scenarios in redd dewatering risk are presented in Table 5C.5.2-94. The total number of redd cohorts that would experience a 50% month-over-month flow decrease would be nearly identical between EBC2_ELT and ESO_ELT and between EBC2_LLT and ESO_LLT. These results indicate that there would be no effect of the ESO on river lamprey redd dewatering in the Stanislaus River.

Because neither the exact locations of Pacific and river lamprey redds nor flow-WUA relationships for Pacific and river lamprey were used in this analysis, these results represent a relative estimate of redd dewatering among model scenarios. Therefore, there is low certainty in these conclusions.

5C.5.2.7.4.2 Ammocoete

Water Temperature

Pacific lamprey ammocoetes rear in the Stanislaus River for five to seven years. River lamprey rear in the Stanislaus River for three to five years. The potential year-round water temperature effects of the ESO on lamprey ammocoetes were evaluated using Reclamation Temperature Model outputs for Knights Ferry and Riverbank. Mean monthly temperatures by month and water-year type for Knights Ferry and Riverbank are presented in Table 5C.5.2-278 and Table 5C.5.2-280, respectively. Differences between pairs of model scenarios for Knights Ferry and Riverbank are presented in Table 5C.5.2-279 and Table 5C.5.2-281, respectively. These results indicate that water temperatures under ESO_ELT and ESO_LLT at both locations in the American River would be similar to temperatures under EBC2_ELT and EBC2_LLT year-round regardless of month or water-year type. Further, there would be no differences in year-round water temperatures in the Stanislaus River between the ESO scenarios and HOS and LOS scenarios (Table 5C.5.2-282 through Table 5C.5.2-285). Therefore, there would be no temperature-related effects of the ESO on lamprey ammocoetes. As a result, no further water temperature-related biological analyses on lamprey ammocoetes are reported. Because this analysis uses water temperature model outputs based on CALSIM outputs, error has been propagated and the level of certainty of these results is moderate.

Stranding

To determine the effects of the ESO on ammocoete stranding risk to Pacific and river lamprey in the Stanislaus River, the number and frequency of ammocoete "cohorts" experiencing a month-over-month decrease in flow ranging from greater than 50% to greater than 90% at the confluence with the San Joaquin River was determined from CALSIM model outputs. The range of flow reductions was 50–90% (in 5% increments) and included the range in which model scenarios were distinguishable and indistinguishable from one another. For Pacific lamprey, a “cohort” of ammocoetes was assumed to be “born” every month during their spawning period (January–August) and spend five years rearing upstream. For river lamprey, cohorts were assumed to be born every month during February through June and spend five years rearing upstream. A cohort was considered “stranded” if at least one month-over-month flow reduction was greater than the each flow reduction at any time during the seven-year (for Pacific lamprey) or five-year rearing period (for river lamprey). Due to similarities in flows in the Stanislaus River between the ESO scenario and HOS and LOS scenarios (Table 5C.5.2-265, Table 5C.5.2-266), this analysis was not conducted for HOS and LOS scenarios.

The number of Pacific lamprey ammocoete cohorts that may be affected by month-over-month flow reductions in the Stanislaus River at the confluence with the San Joaquin River is presented in Figure 5C.5.2-195 and differences between model scenarios are presented in Table 5C.5.2-286. The numbers of Pacific lamprey ammocoetes exposed under EBC2_ELT and EBC2_LLT would be nearly identical to the number under ESO_ELT and ESO_LLT.

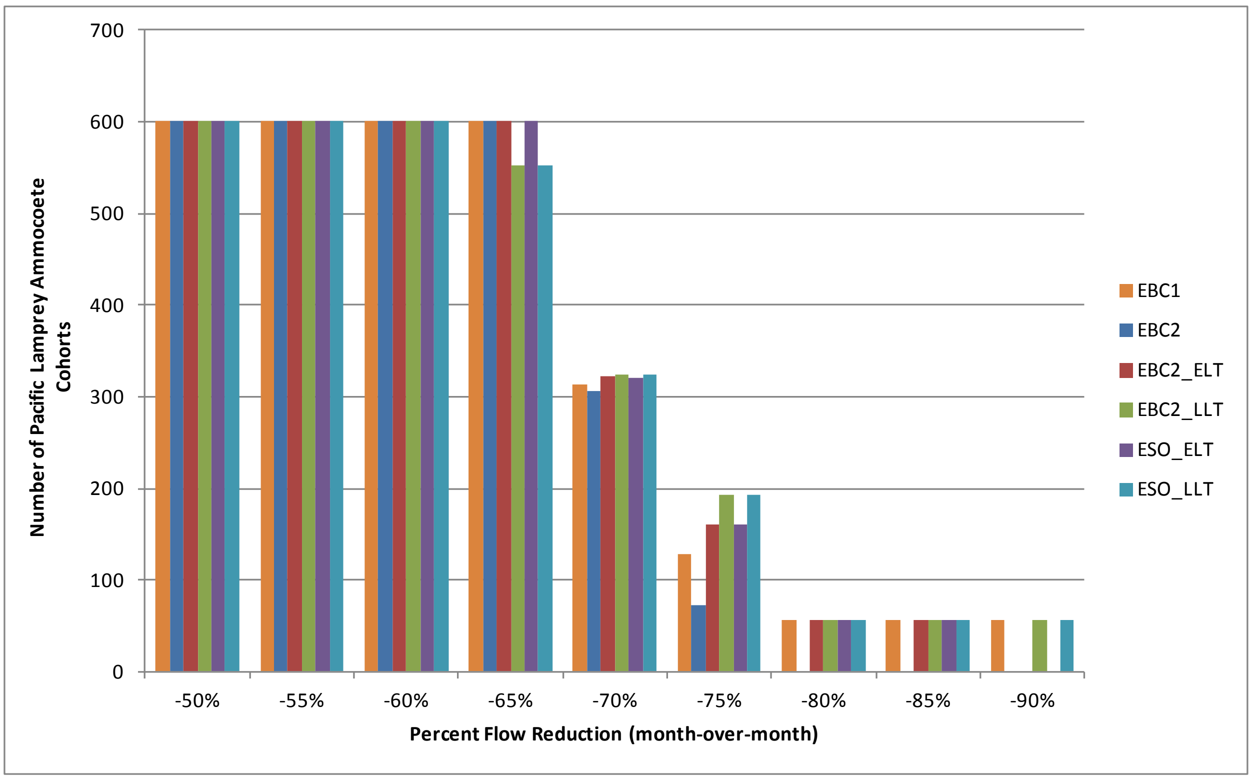


Figure 5C.5.2-195. Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions of 50% to 90%, Stanislaus River at the Confluence with the San Joaquin River, under EBC and ESO Scenarios

Table 5C.5.2-286. Differences between EBC and ESO Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Stanislaus River at the Confluence with the San Joaquin River

Flow Reduction	Percent Difference between Scenarios[a, b]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
50%	0	0	0	0	0	0
55%	0	0	0	0	0	0
60%	0	0	0	0	0	0
65%	0	-8	0	-8	0	0
70%	2	3	5	6	-1	0
75%	25	51	122	168	0	0
80%	0	0	NA	NA	0	0
85%	0	0	NA	NA	0	0
90%	-100	0	NA	NA	NA	0

[a] Negative values indicate reduced cohort exposure under ESO.
[b] See Table 5C.0-1 for definitions of the scenarios.
NA = Could not be calculated because dividing by 0.

The number of river lamprey ammocoete cohorts that may be affected by month-over-month flow reductions in the Stanislaus River at the confluence with the San Joaquin River is presented in Figure 5C.5.2-195, and differences between model scenarios are presented in Table 5C.5.2-287. The numbers of river lamprey ammocoetes exposed under EBC2_ELT and EBC2_LLT would be nearly identical to the number under ESO_ELT and ESO_LLT. These results indicate that there are negligible effects of the ESO on ammocoetes of both lamprey species under the early and late long-term in the Stanislaus River.

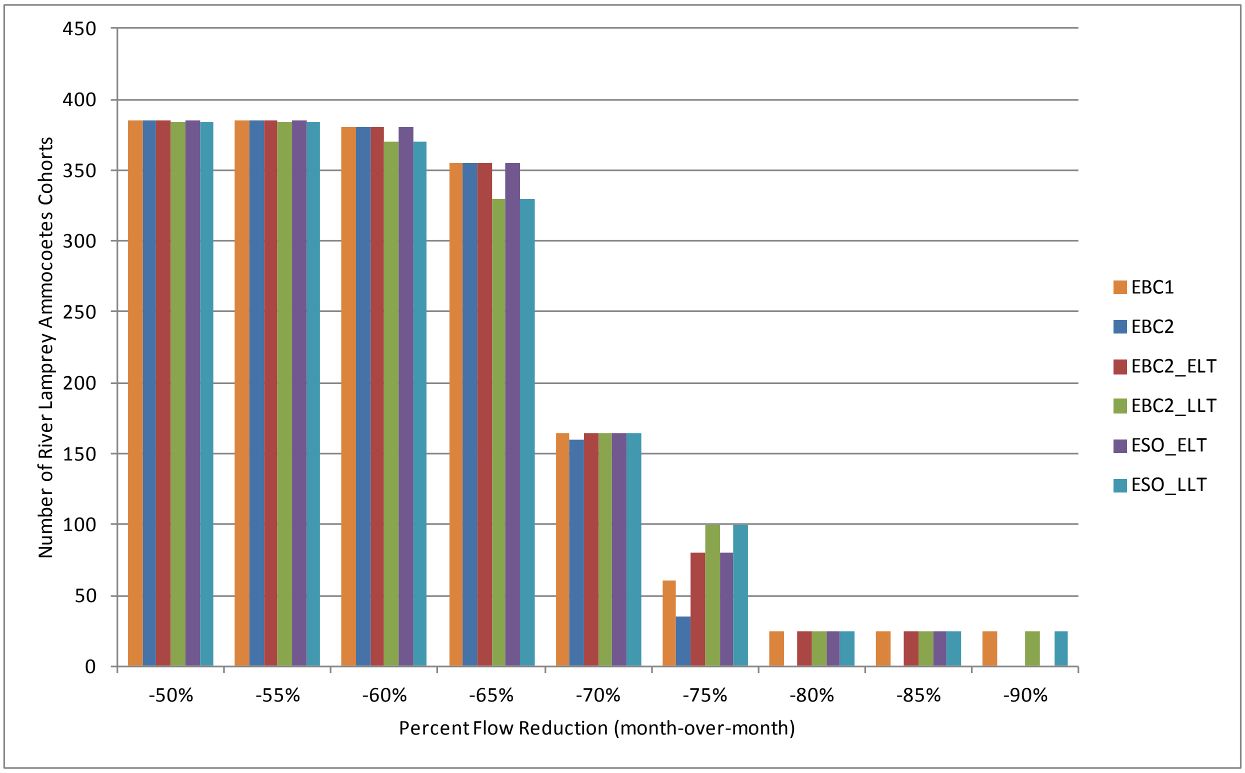


Figure 5C.5.2-196. Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions of 50% to 90%, Stanislaus River at the Confluence with the San Joaquin River, under EBC and ESO Scenarios

Table 5C.5.2-287. Difference between EBC and ESO Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Stanislaus River at the Confluence with the Sacramento River

Flow Reduction	Percent Difference between Scenarios[a, b]					
	EBC1 vs. ESO_ELT	EBC1 vs. ESO_LLT	EBC2 vs. ESO_ELT	EBC2 vs. ESO_LLT	EBC2_ELT vs. ESO_ELT	EBC2_LLT vs. ESO_LLT
50%	0	-0.3	0	-0.3	0	0
55%	0	-0.3	0	-0.3	0	0
60%	0	-3	0	-3	0	0
65%	0	-7	0	-7	0	0
70%	0	0	3	3	0	0
75%	33	67	129	186	0	0
80%	0	0	NA	NA	0	0
85%	0	0	NA	NA	0	0
90%	-100	0	NA	NA	NA	0

[a] Negative values indicate reduced cohort exposure under ESO.
[b] See Table 5C.0-1 for definitions of the scenarios.
NA = Could not be calculated because dividing by 0.