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## 4. Environmental Consequences and Mitigation Measures

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### 4.5 AQUATIC RESOURCES

This section assesses the impacts to aquatic resources that could be affected by the proposed action and the alternative action.

#### 4.5.1 Key Impact Issues and Evaluation Criteria

The aquatic resources within the project area have been defined in terms of existing habitats represented by unique Ecological Zones as described in Section 3.5.1. Riverine systems that provide spawning and rearing habitat, as well as passage into and out of the Delta for anadromous species of fish, form the basis for the impact analysis. Also considered are the reservoir habitats provided by the three major reservoirs in the project area. The estuarine habitats of the Delta are included only to the extent that they are impacted indirectly by the cumulative effects of the proposed project.

Indicator fish species, that occur within the project area during one or more environmentally sensitive stages of their life cycle, were chosen as important representatives of aquatic ecosystem responses to changes caused by the proposed project and its alternative. Fall-run chinook salmon were selected as the species of prime interest because water contributed by the proposed project is designated to provide protection for this species in the San Joaquin River Basin. The analysis of chinook salmon also encompasses steelhead trout, an anadromous species closely related to salmon. Other, less widely distributed species included in this analysis, are splittail and striped bass. Splittail are a native species currently proposed as a federally threatened species. Striped bass are included because of their commercial value as a game fish. The representative species selected for reservoir habitats is the largemouth bass.

The criterion used to determine the level of riverine impact associated with implementation of the project is based on average percentage changes to stream flow as compared to base conditions. Thresholds of impact significance were established as follows (see Section 4.1.2 for definitions of these categories):

- |                                      |  |
|--------------------------------------|--|
| • greater than +10 percent change    | Beneficial                             |
| • less than $\pm 10$ percent change  | Not significant                        |
| • between -11 and -25 percent change | Less than significant                  |
| • greater than -25 percent change    | Potentially significant or Significant |

Thresholds were derived based on the ability to accurately measure stream flow discharges to  $\pm 10$  percent (USGS 1977). A change from -11 to -25 percent was considered measurable, but less than significant, because it would likely result in only minor changes in usable habitats. This is based in part on results of a study that combined weighted usable area (WUA) and stream temperatures as related to salmon habitat (EA 1993). Operational releases are not permitted to fall below established

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minimum flow requirements. For more discussion of the assessment methodology, see Appendix H, response 11 to comment 11 by NMFS.

Currently, minimum flow requirements have been established by the Federal Energy Regulatory Commission (FERC) for the Tuolumne River to protect fishery resources. For the Merced River, both the FERC license and the Davis-Grunsky contract provide minimum flow standards. Flow objectives for the Stanislaus River have been established in the New Melones Interim Plan of Operation (USBR 1997c).

The criterion for reservoir species impacts was an assessment of the percent change in water surface elevation, by water year type, of the three major reservoirs, for the months of April through July. This time period represents the optimal spawning period for largemouth bass. Water surface elevations were derived from water surface elevations vs. storage relationships for each reservoir. Average change in storage was then computed for each water year type, converted to water surface elevation, and compared to conditions. Thresholds of impact significance were established as follows:

- |                                      |  |
|--------------------------------------|--|
| • greater than +10 percent change    | Beneficial                             |
| • less than $\pm 10$ percent change  | Not significant                        |
| • between -11 and -20 percent change | Less than significant                  |
| • greater than -20 percent change    | Potentially significant or Significant |

Thresholds were derived based on the ability to accurately model changes in reservoir water surface elevations to  $\pm 10$  percent (SWRCB 1998).

For both riverine and reservoir assessment, the no action and proposed action results from the hydrological modeling analysis (Appendix A) were used. This hydrologic analysis considered a hydrologic sequence of 71 years (1922 through 1992) and included the following range of water year types: 1) Critically Dry, 2) Dry, 3) Below Normal, 4) Above Normal, or 5) Wet. The No Action alternative represents the base case for comparing the alternatives. The 71-year period was used to evaluate the potential effects of the project over a the series of water year types, since the actual hydrology during project implementation would be unknown. Average percent changes over this 71-year hydrologic sequence were developed by water year type and used in the evaluation of the proposed project as compared with the base case.

The SWRCB (1998) results were used for an evaluation of conditions under the Water Right Priority System alternative. This analysis used a different operations model (DWRSIM) and a different base case, therefore the results were not directly comparable to those used to evaluate the proposed alternative. To evaluate the Water Right Priority System, an analysis between the SWRCB Alternative 2 (SWP/CVP used to meet the standards) and the alternative action (Alternative 3) was used to qualitatively determine impacts.

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### 4.5.2 Environmental Consequences

The proposed project would provide additional stream flow largely in the form of October attraction flows and spring pulse flows. The project would provide water primarily through reservoir releases, bypass, and releases from storage. Reservoir storage would then be refilled during above normal and wet water year types, resulting in reduced stream flows (see Section 4.2 for discussion of water supply changes). The project would obtain up to 50 percent of its water from Lake McClure on the Merced River, with the majority of the remaining water coming from willing sellers on the Stanislaus, Tuolumne, and mainstem San Joaquin rivers.

#### 4.5.2.1 Habitats and Ecological Zones

The Ecological Zones described in Section 3.5.1 contain complex relationships between the physical habitats and species assemblages found within them. These zones represent entire ecosystems that provide numerous and highly variable habitats for many species. No criterion exists to determine the significance of impacts across all of the habitats occurring within the zones on an ecosystem level. Consequentially, assessments of impacts within these zones are made through the use of indicator aquatic species. These species, which are dependent on a suite of aquatic habitats for reproduction, growth, and development, provide a link to the ecosystem level of biological organization.

**No Action.** The No Action alternative results in no changes to existing conditions. The No Action alternative includes flow releases in accordance with the various operating plans, settlement agreements, and FERC requirements now in place for the San Joaquin River Basin. Fluctuation of reservoir levels occur to the extent required to meet these flow releases. Since No Action represents the baseline, no impacts are identified for implementation of this alternative.

**Proposed Action.** Of the four Ecological Zones within the project area, only the San Joaquin River and East San Joaquin Basin zones are directly affected by the project. The project would provide flows in addition to those from the base case, with the Merced River experiencing the largest increases. Small reductions in flow would also occur as a result of reservoir recharge. The largest reductions in flow would occur on the Merced River in above normal and wet water year types. The proposed action would coordinate flow releases from among the three major reservoirs resulting in fluctuations of water level in the reservoirs. Because no criteria exists for assessing impacts to Ecological Zones, no determination of significance can be made.

**Alternative Action.** Neither the SWRCB (1998) Alternative 3 (the Water Right Priority System) nor the Alternative 2 (comparable base case), includes a discussion of Ecological Zones, or equivalent ecosystem level components. The alternative action could result in different flow regimes and reservoir levels when compared with the base case (Alternative 2). Consequently, it is not possible to evaluate impacts at the Ecological Zone level of biological organization. However, the general

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changes would be similar to the proposed action in that both would provide additional flows during October and April or May, with resulting water level fluctuations occurring in major project reservoirs. No determination of significance can be made.

### 4.5.2.2 Factors Affecting the Distribution and Abundance of Aquatic Resources in the San Joaquin River Basin and Bay/Delta Estuary

A list of factors that affect the distribution and abundance of aquatic resources in the project area and Delta was presented in Section 3.5.2. These factors include; 1) Natural environmental variability, 2) Water development, 3) Introduced species, 4) Food supply, 5) Harvest, 6) Pollution, and 7) Reservoirs. Of these factors, only Pollution (Water Quality) and Reservoirs, are directly impacted by the project. Reservoir issues relating to selected indicator species are discussed in Section 4.5.2.3. Changes in surface water quality are discussed in Section 4.2.2.3.

**No Action.** The No Action alternative results in no changes to existing conditions.

**Proposed Action.** Implementation of the proposed action positively benefits water quality due to increased flow at Vernalis and would, therefore, not adversely affect aquatic resources.

**Alternative Action.** Implementation of the alternative action positively benefits water quality due to increased flows and would, therefore, not adversely affect aquatic resources.

### 4.5.2.3 Indicator Species

Indicator fish species provide a link between effects on individual organisms and consequences at the population, community, and aquatic ecosystem or “ecological unit” (see Section 4.5.2.1) levels of biological organization. The assessment of impacts to selected indicator species are based on the amount of change in stream flow or reservoir levels. Changes in flow (or reservoir levels) relate directly to the amount and quality of available physical habitat for various life stages of the indicator species and hence to its population distribution, numbers, and dynamics (change in distribution and numbers through time). To transform the magnitude of change in flow to impacts, threshold values were identified for not significant, less-than-significant, and potentially significant changes (see Section 4.5.2.1). Table 4.5-1A shows the average monthly percent change in flow (cfs) by water year type for specific reaches of the San Joaquin River and its tributaries. Table 4.5-1A was created

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**TABLE 4.5-1A: AVERAGE PERCENT CHANGES IN CFS FOR RIVERS WITH APRIL/MAY PROJECT COMPARED WITH BASE CASE BY WATER YEAR TYPE**

STANISLAUS RIVER – AVERAGE PERCENT CHANGE IN CFS WITH PROJECT (APRIL)													
WY Type	October	November	December	January	February	March	April	May	June	July	August	September	WY Average
Wet	6	3	9	6	5	14	5	4	5	3	0	1	5
Above	4	2	2	34	6	5	2	14	13	0	0	1	7
Below	0	1	1	2	2	5	9	25	-2	0	9	0	4
Drv	48	8	8	18	7	2	13	1	-1	6	1	0	9
Critical	2	3	3	4	3	5	9	1	5	8	0	0	4
STANISLAUS RIVER – AVERAGE PERCENT CHANGE IN CFS WITH PROJECT (MAY)													
WY Type	October	November	December	January	February	March	April	May	June	July	August	September	WY Average
Wet	5	2	3	7	4	12	4	4	11	2	0	1	4
Above	2	1	1	34	6	4	3	24	9	0	7	0	7
Below	0	1	1	2	2	4	23	10	-2	0	1	0	4
Drv	43	8	8	18	6	2	3	12	1	1	1	0	9
Critical	2	2	2	4	3	4	3	16	4	9	0	0	4
TUOLUMNE RIVER – AVERAGE PERCENT CHANGE IN CFS WITH PROJECT (APRIL)													
WY Type	October	November	December	January	February	March	April	May	June	July	August	September	WY Average
Wet	-1	1	-8	-1	-4	0	0	-1	0	-2	-1	1	-1
Above	-1	0	-2	-1	-2	-5	9	-2	1	-2	-2	1	-1
Below	0	1	-1	-3	0	-4	32	1	11	8	8	11	5
Drv	-2	-1	-1	-1	-4	-1	43	-2	6	4	4	6	4
Critical	1	1	-2	-2	-2	-2	6	-3	0	-2	-2	0	-1
TUOLUMNE RIVER – AVERAGE PERCENT CHANGE IN CFS WITH PROJECT (MAY)													
WY Type	October	November	December	January	February	March	April	May	June	July	August	September	WY Average
Wet	-1	1	-7	-1	-5	0	0	1	0	-2	-1	1	-1
Above	-1	0	-5	-1	-4	-5	-1	22	1	-2	-2	1	0
Below	0	0	-1	-5	0	-4	-5	33	11	8	8	11	4
Drv	-2	-1	-1	-1	-2	-1	1	42	7	4	4	7	5
Critical	1	1	-2	-2	-2	-2	1	11	0	-2	-2	0	0

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**TABLE 4.5-1A: AVERAGE PERCENT CHANGES IN CFS FOR RIVERS WITH APRIL/MAY PROJECT COMPARED WITH BASE CASE BY WATER YEAR TYPE (CONT.)**

MERCED RIVER – AVERAGE PERCENT CHANGE IN CFS WITH PROJECT (APRIL)													
WY Type	October	November	December	January	February	March	April	May	June	July	August	September	WY Average
Wet	2,519	-4	-7	-15	-15	-1	1	-2	-2	0	1	-2	206
Above	1,835	-1	-6	-1	-5	-20	139	-11	-9	2	1	0	160
Below	399	-2	0	0	-3	0	363	2	1	2	0	0	64
Dry	438	-7	0	-3	-7	0	356	2	1	1	0	0	65
Critical	3,446	-8	0	0	0	0	127	2	1	1	0	42	301
MERCED RIVER – AVERAGE PERCENT CHANGE IN CFS WITH PROJECT (MAY)													
WY Type	October	November	December	January	February	March	April	May	June	July	August	September	WY Average
Wet	2,519	-4	-7	-21	-16	-1	-2	22	-9	0	1	-2	207
Above	1,835	-1	-6	-3	-7	-21	-22	234	-20	2	1	0	166
Below	396	-2	0	0	-3	0	-4	275	1	2	0	0	55
Dry	438	-7	0	-3	-9	0	-4	271	1	1	0	0	57
Critical	3,446	-8	0	0	0	0	-3	122	1	1	0	42	300
SJR at VERNALIS – AVERAGE PERCENT CHANGE IN CFS WITH PROJECT (APRIL)													
WY Type	October	November	December	January	February	March	April	May	June	July	August	September	WY Average
Wet	11	-1	-2	-1	-3	0	1	0	0	0	0	0	0
Above	10	0	-2	1	-2	-4	8	0	-1	0	0	0	1
Below	11	0	0	0	0	0	27	4	0	0	3	1	4
Dry	16	-1	2	3	-1	0	35	0	0	3	1	0	5
Critical	16	-1	0	0	0	0	16	0	2	2	-1	0	3
SJR at VERNALIS – AVERAGE PERCENT CHANGE IN CFS WITH PROJECT (MAY)													
WY Type	October	November	December	January	February	March	April	May	June	July	August	September	WY Average
Wet	10	-1	-2	-3	-3	0	0	2	-1	0	0	0	0
Above	10	0	-2	0	-3	-5	-1	23	-3	0	0	0	2
Below	9	0	0	-1	0	0	2	30	0	0	1	0	3
Dry	15	-1	2	3	-1	0	0	39	1	1	1	1	5
Critical	16	-2	0	0	0	0	0	25	2	3	-1	0	4

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**TABLE 4.5-1A: AVERAGE PERCENT CHANGES IN CFS FOR RIVERS WITH APRIL/MAY PROJECT COMPARED WITH BASE CASE BY WATER YEAR TYPE (CONT.)**

SJR below TUOLUMNE – AVERAGE PERCENT CHANGE IN CFS WITH PROJECT (APRIL)													
WY Type	October	Novemb	December	January	February	March	April	May	June	July	August	September	WY Average
Wet	12	-1	-3	-2	-4	0	0	0	0	0	0	0	0
Above Normal	11	0	-2	0	-3	-5	12	-3	-3	0	0	0	1
Below Normal	12	0	0	-1	-1	-1	42	0	1	1	1	1	5
Dry	10	-3	0	-1	-3	0	55	0	1	1	1	1	5
Critical	18	-2	0	0	0	0	21	0	0	0	-1	0	3
SJR below TUOLUMNE – AVERAGE PERCENT CHANGE IN CFS WITH PROJECT (MAY)													
WY Type	October	Novemb	December	January	February	March	April	May	June	July	August	September	WY Average
Wet	12	-1	-3	-4	-4	0	0	3	-3	0	0	0	0
Above Normal	11	0	-3	-1	-4	-6	-3	33	-6	0	0	0	2
Below Normal	11	0	0	-1	-1	-1	-1	47	1	1	1	1	5
Dry	10	-3	0	-1	-3	0	0	64	1	1	1	1	6
Critical	18	-2	0	0	0	0	0	33	0	-1	-1	0	4
SJR below MERCED – AVERAGE PERCENT CHANGE IN CFS WITH PROJECT (APRIL)													
WY Type	October	Novemb	December	January	February	March	April	May	June	July	August	September	WY Average
Wet	27	-3	-3	-5	-7	-1	1	-1	-1	0	0	0	1
Above Normal	23	0	-3	0	-3	-10	38	-6	-6	1	0	0	3
Below Normal	26	-1	0	0	-1	0	108	0	0	0	0	0	11
Dry	22	-4	0	-1	-3	0	119	0	0	0	0	0	11
Critical	36	-4	0	0	0	0	52	0	0	0	-1	-1	7
SJR below MERCED – AVERAGE PERCENT CHANGE IN CFS WITH PROJECT (MAY)													
WY Type	October	Novemb	December	January	February	March	April	May	June	July	August	September	WY Average
Wet	27	-3	-3	-8	-7	-1	-1	9	-6	0	0	-1	1
Above Normal	23	0	-3	-1	-4	-10	-8	97	-12	1	0	0	7
Below Normal	24	-1	0	0	-1	0	-1	114	0	0	0	0	11
Dry	22	-4	0	-1	-4	0	-1	122	0	0	0	0	11
Critical	36	-4	0	0	0	0	-1	62	0	0	-1	0	8

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by first calculating the percent change in flow from base conditions, represented by the No Action alternative, to the proposed action. These percentages were then averaged by water year type.

Table 4.5-1B shows the average monthly flow by water year that result from modeled flows for both the April/May base case and the April/May project. These averages are provided for information purposes only and have not been used in the determination of impacts. Note that the difference between averages will not be the same number as the average of individual differences. Consequently, one cannot take the average percentage change (in flows) given in Table 4.5-1A and apply them directly to Table 4.5-1B. Conversely, percentage change in averages calculated from Table 4.5-1B will not be the same number as those given in Table 4.5-1A.

Table 4.5-2 summarizes the average water surface elevations in project area reservoirs along with the percent monthly changes for April through July by water year type.

The effects of implementing the proposed project and its alternative are evaluated using the following indicator species: chinook salmon, steelhead trout, striped bass, splittail, and largemouth bass. Consideration is given to the specific life stages (including the egg stage) which occur within each river system. The key indicator species identified for this document is the fall-run chinook salmon.

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**TABLE 4.5-1B: AVERAGE MONTHLY CFS FOR RIVERS WITH AND WITHOUT APRIL/MAY PROJECT ALONG WITH BASE CASE FOR APRIL/MAY BY WATER YEAR TYPE**

STANISLAUS RIVER – AVERAGE CFS WITH PROJECT (APRIL)													
WY Type	October	November	December	January	February	March	April	May	June	July	August	Septembe	WY Average
Wet	445	406	468	621	873	1467	1564	1364	1203	588	556	348	825
Above	811	480	627	773	734	431	1229	899	696	620	607	265	681
Below	531	300	320	341	346	242	1172	664	599	718	599	257	507
Drv	786	355	364	422	570	208	1108	666	928	689	519	252	572
Critical	174	241	241	202	209	142	612	599	714	297	283	249	330
STANISLAUS RIVER – AVERAGE CFS WITHOUT PROJECT (APRIL)													
WY Type	October	November	December	January	February	March	April	May	June	July	August	Septembe	WY Average
Wet	416	397	437	573	805	1356	1502	1323	1155	579	558	339	787
Above	787	476	623	707	674	417	1222	823	662	619	609	263	657
Below	491	296	317	335	342	232	1110	577	608	717	561	256	487
Drv	548	325	332	351	543	206	023	662	936	659	508	253	529
Critical	173	237	236	195	203	137	558	595	687	271	283	249	319
STANISLAUS RIVER – AVERAGE CFS WITH PROJECT (MAY)													
WY Type	October	November	December	January	February	March	April	May	June	July	August	Septembe	WY Average
Wet	442	402	446	618	862	1465	1377	1545	1221	585	553	348	822
Above	811	480	627	763	734	429	897	1291	751	616	601	265	689
Below	532	299	320	340	346	239	621	1180	603	720	587	257	504
Drv	771	355	363	421	574	207	603	1094	949	693	535	253	568
Critical	174	241	241	201	209	141	538	661	722	306	283	249	330
STANISLAUS RIVER – AVERAGE CFS WITHOUT PROJECT (MAY)													
WY Type	October	November	December	January	February	March	April	May	June	July	August	Septembe	WY Average
Wet	416	397	436	558	800	1358	1330	1491	1148	577	555	338	784
Above	786	475	623	706	670	417	817	1221	703	611	605	263	658
Below	499	296	316	335	341	231	542	1106	612	720	578	256	486
Drv	557	325	332	350	552	205	595	1017	940	692	529	253	529
Critical	172	237	236	195	203	137	530	569	705	276	283	249	316

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**TABLE 4.5-1B: AVERAGE MONTHLY CFS FOR RIVERS WITH AND WITHOUT APRIL/MAY PROJECT ALONG WITH BASE CASE FOR APRIL/MAY BY WATER YEAR TYPE (CONT.)**

TUOLUMNE RIVER – AVERAGE CFS WITH PROJECT (APRIL)													
WY Type	October	November	December	January	February	March	April	May	June	July	August	September	WY Average
Wet	420	496	747	2616	3626	3717	2803	2094	2429	681	502	806	1745
Above	296	628	1137	1632	2170	963	1974	307	301	244	244	252	846
Below	282	494	412	661	714	387	1501	179	84	81	81	84	413
Dry	341	477	262	262	656	262	1067	155	72	69	69	72	314
Critical	196	215	180	180	181	180	491	146	50	49	49	50	164
TUOLUMNE RIVER – AVERAGE CFS WITHOUT PROJECT (APRIL)													
50WY Type	October	November	December	January	February	March	April	May	June	July	August	September	WY Average
Wet	423	493	808	2622	3739	3717	2800	2096	2429	686	505	802	1760
Above	299	628	1166	1634	2233	987	1810	312	299	250	250	250	843
Below	284	492	415	681	712	409	1138	177	76	75	75	76	384
Dry	347	476	265	265	668	265	752	158	67	66	66	67	289
Critical	195	212	184	184	184	184	455	150	50	50	50	50	162
TUOLUMNE RIVER – AVERAGE CFS WITH PROJECT (MAY)													
WY Type	October	November	December	January	February	March	April	May	June	July	August	September	WY Average
Wet	420	496	708	2544	3510	3716	2576	2600	2289	681	502	798	1737
Above	296	628	1027	1626	2038	950	589	2156	252	244	244	252	859
Below	282	419	412	632	714	367	330	1350	84	81	81	84	403
Dry	341	477	262	262	656	262	268	1032	72	69	69	72	320
Critical	196	215	180	180	181	180	151	499	50	49	49	50	165
TUOLUMNE RIVER – AVERAGE CFS WITHOUT PROJECT (MAY)													
WY Type	October	November	December	January	February	March	April	May	June	July	August	September	WY Average
Wet	423	493	763	2573	3641	3717	2577	2577	2228	686	505	795	1753
Above	299	628	1100	1633	2119	979	592	1761	250	250	250	250	843
Below	284	430	415	661	712	388	352	1022	76	75	75	76	381
Dry	347	476	265	265	660	265	265	729	67	66	66	67	295
Critical	195	212	184	184	184	184	150	445	50	50	50	50	161

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**TABLE 4.5-1B: AVERAGE MONTHLY CFS FOR RIVERS WITH AND WITHOUT APRIL/MAY PROJECT ALONG WITH BASE CASE FOR APRIL/MAY BY WATER YEAR TYPE (CONT.)**

MERCED RIVER – AVERAGE CFS WITH PROJECT (APRIL)													
WY Type	October	November	December	January	February	March	April	May	June	July	August	September	WY Average
Wet	385	345	396	912	1746	2508	1976	1542	1569	646	269	519	1068
Above	500	510	483	730	967	640	665	320	322	228	130	42	461
Below	391	357	190	305	282	232	811	228	251	224	73	25	281
Dry	535	312	209	223	279	179	799	228	243	173	28	43	281
Critical	240	188	150	149	175	170	404	229	237	122	46	31	178
MERCED RIVER – AVERAGE CFS WITHOUT PROJECT (APRIL)													
WY Type	October	November	December	January	February	March	April	May	June	July	August	September	WY Average
Wet	215	379	439	1125	2074	2528	1974	1573	1601	643	266	524	1112
Above	364	516	636	741	1148	836	441	385	404	224	129	42	489
Below	240	362	190	305	297	232	175	224	249	220	73	25	216
Dry	406	376	209	231	322	179	175	224	240	172	28	43	217
Critical	50	229	150	149	175	170	177	224	235	120	46	30	146
MERCED RIVER – AVERAGE CFS WITH PROJECT (MAY)													
WY Type	October	November	December	January	February	March	April	May	June	July	August	September	WY Average
Wet	383	345	396	812	1724	2501	1946	1644	1496	643	269	519	1057
Above	500	509	483	696	897	623	323	1053	252	228	130	42	478
Below	366	357	190	305	282	232	168	840	251	224	73	25	276
Dry	535	312	209	223	265	179	168	832	243	173	28	43	267
Critical	240	186	150	149	175	170	172	498	237	122	46	31	181
MERCED RIVER – AVERAGE CFS WITHOUT PROJECT (MAY)													
WY Type	October	November	December	January	February	March	April	May	June	July	August	September	WY Average
Wet	215	379	439	1125	2074	2528	1974	1573	1601	643	266	524	1112
Above	364	516	636	741	1148	836	441	385	404	224	129	42	489
Below	240	362	190	305	297	232	175	224	249	220	73	25	216
Dry	406	376	209	231	322	179	175	224	240	172	28	43	217
Critical	50	229	150	149	175	170	177	224	235	120	46	30	146

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**TABLE 4.5-1B: AVERAGE MONTHLY CFS FOR RIVERS WITH AND WITHOUT APRIL/MAY PROJECT ALONG WITH BASE CASE FOR APRIL/MAY BY WATER YEAR TYPE (CONT.)**

SAN JOAQUIN RIVER at VERNALIS – AVERAGE CFS WITH PROJECT (APRIL)													
WY Type	October	November	December	January	February	March	April	May	June	July	August	September	WY Average
Wet	2384	2499	3948	7900	13386	15398	13756	11843	8480	3416	2456	2686	7346
Above	2693	3059	4172	5858	7684	5374	7154	3584	2828	2185	2076	1639	4025
Below	2161	2197	2037	2419	3273	2864	5590	2511	2172	2006	1841	1439	2543
Dry	2528	214	1781	1888	2857	1991	4259	1820	1892	1440	1271	1104	2081
Critical	1520	1532	1370	1318	1676	1621	2343	1406	1368	855	790	904	1392
SAN JOAQUIN RIVER at VERNALIS – AVERAGE CFS WITHOUT PROJECT (APRIL)													
WY Type	October	November	December	January	February	March	April	May	June	July	August	September	WY Average
Wet	2189	2522	4021	8071	13759	15307	13688	11834	8463	3410	2462	2678	7367
Above	2537	3060	4351	5802	7866	5578	6720	3581	2875	2188	2084	1635	4023
Below	1971	2195	2035	2434	3280	2876	4415	2422	2171	2003	1793	1431	2419
Dry	2165	2179	1753	1827	2885	1994	3120	1817	1896	1407	1256	1099	1950
Critical	1330	1564	1370	1315	1676	1620	2001	1403	1342	831	797	904	1346
SAN JOAQUIN RIVER at VERNALIS – AVERAGE CFS WITH PROJECT (MAY)													
WY Type	October	November	December	January	February	March	April	May	June	July	August	September	WY Average
Wet	2378	2495	3866	7726	13236	15388	13311	12636	8284	3410	2453	2679	7323
Above	2688	3062	4064	5810	7481	5338	5053	6675	2765	2181	2069	1638	4069
Below	2137	2121	2037	2389	3272	2842	3144	4912	2180	2013	1832	1437	2524
Dry	2512	2144	1781	1887	2848	1990	2212	3823	1919	1447	1288	1107	2080
Critical	1519	1529	1369	1317	1678	1621	1671	2121	1380	866	795	904	1398
SAN JOAQUIN RIVER at VERNALIS – AVERAGE CFS WITHOUT PROJECT (MAY)													
WY Type	October	November	December	January	February	March	April	May	June	July	August	September	WY Average
Wet	2188	2523	3975	8007	13657	15309	13292	12484	8315	3406	2458	2671	7357
Above	2532	3061	4268	5805	7753	5568	5096	5427	2866	2179	2076	1635	4024
Below	1978	2135	2033	2413	3280	2855	3065	3790	2175	2005	1815	1432	2415
Dry	2175	2179	1753	1827	2885	1993	2212	2735	1906	1441	1277	1098	1957
Critical	1330	1565	1369	1313	1673	1620	1669	1675	1365	840	800	904	1344

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**Table 4.5-2: AVERAGE WATER SURFACE ELEVATIONS AND PERCENT CHANGES FOR RESERVOIRS WITH APRIL/MAY PROJECT COMPARED WITH BASE CASE BY WATER YEAR TYPE**

NEW MELONES NO-ACTION – APRIL							
WY Type	ELEVATION				PERCENT CHANGE		
	April	May	June	July	Apr-May	May-Jun	Jun-Jul
Wet	1034	1049	1058	1053	1.5	0.9	-0.5
Above	1000	1013	1014	1004	1.5	0.1	-1.0
Below	1002	1007	1006	995	0.5	-0.1	-1.1
Dry	1011	1005	994	981	-0.6	-1.1	-1.3
Critical	955	945	933	923	-1.0	-1.3	-1.1
NEW MELONES PROPOSED ACTION – APRIL							
WY Type	ELEVATION				PERCENT CHANGE		
	April	May	June	July	Apr-May	May-Jun	Jun-Jul
Wet	1037	1053	1062	1057	1.5	0.9	-0.5
Above	1007	1019	1020	1010	1.2	0.1	-1.0
Below	1008	1012	1012	1000	0.4	0.0	-1.2
Dry	1015	1009	998	986	-0.6	-1.1	-1.2
Critical	965	955	943	932	-1.0	-1.3	-1.2
NEW MELONES NO-ACTION – MAY							
WY Type	ELEVATION				PERCENT CHANGE		
	April	May	June	July	Apr-May	May-Jun	Jun-Jul
Wet	1035	1048	1058	1053	1.3	1.0	-0.5
Above	1003	1013	1014	1004	1.0	0.1	-1.0
Below	1005	1007	1006	995	0.2	-0.1	-1.1
Dry	1014	1006	955	981	-0.8	-1.1	-1.4
Critical	957	947	934	929	-1.0	-1.4	-1.1
NEW MELONES PROPOSED ACTION – MAY							
WY Type	ELEVATION				PERCENT CHANGE		
	April	May	June	July	Apr-May	May-Jun	Jun-Jul
Wet	1039	1052	1061	1056	1.3	0.9	-0.5
Above	1009	1018	1019	1009	0.9	0.1	-1.0
Below	1011	1012	1011	1000	0.1	-0.1	-1.1
Dry	1018	1010	999	986	-0.8	-1.1	-1.3
Critical	966	955	943	933	-1.1	-1.3	-1.1

#### 4. Environmental Consequences and Mitigation Measures

**Table 4.5-2: AVERAGE WATER SURFACE ELEVATIONS AND PERCENT CHANGES FOR RESERVOIRS WITH APRIL/MAY PROJECT COMPARED WITH BASE CASE BY WATER YEAR TYPE (CONT.)**

NEW DON PEDRO NO-ACTION – APRIL							
WY Type	ELEVATION				PERCENT CHANGE		
	April	May	June	July	Apr-May	May-Jun	Jun-Jul
Wet	996	804	822	825	1.0	2.2	0.4
Above	790	799	809	800	1.1	1.3	-1.1
Below	981	789	793	782	0.9	0.5	-1.3
Dry	790	792	786	774	0.3	-0.7	-1.6
Critical	750	748	742	729	-0.2	-0.9	-1.7
NEW DON PEDRO PROPOSED ACTION – APRIL							
WY Type	ELEVATION				PERCENT CHANGE		
	April	May	June	July	Apr-May	May-Jun	Jun-Jul
Wet	796	809	822	825	1.1	2.2	0.4
Above	789	798	808	799	1.2	1.3	-1.1
Below	780	787	791	780	0.9	0.5	-1.3
Dry	788	790	784	772	0.2	-0.7	-1.6
Critical	749	747	741	728	-0.2	-0.9	-1.7
NEW DON PEDRO NO-ACTION – MAY							
WY Type	ELEVATION				PERCENT CHANGE		
	April	May	June	July	Apr-May	May-Jun	Jun-Jul
Wet	797	803	821	824	0.9	2.2	0.3
Above	795	797	807	799	0.3	1.3	-1.1
Below	784	787	791	781	0.4	0.5	-1.3
Dry	792	791	785	773	-0.1	-0.7	-1.6
Critical	751	747	741	728	-0.5	-0.9	-1.7
NEW DON PEDRO PROPOSED ACTION – MAY							
WY Type	ELEVATION				PERCENT CHANGE		
	April	May	June	July	Apr-May	May-Jun	Jun-Jul
Wet	797	803	821	824	0.9	2.2	0.3
Above	794	795	806	796	0.1	1.3	-1.1
Below	783	785	789	778	0.2	0.5	-1.4
Dry	790	789	783	770	-0.2	-0.7	-1.6
Critical	749	745	739	726	-0.6	-0.9	-1.7

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**Table 4.5-2: AVERAGE WATER SURFACE ELEVATIONS AND PERCENT CHANGES FOR RESERVOIRS WITH APRIL/MAY PROJECT COMPARED WITH BASE CASE BY WATER YEAR TYPE (CONT.)**

LAKE MCCLURE NO-ACTION – APRIL							
WY Type	ELEVATION				PERCENT CHANGE		
	April	May	June	July	Apr-May	May-Jun	Jun-Jul
Wet	812	845	863	856	4.1	2.1	-0.9
Above	818	848	853	838	3.7	0.7	-1.7
Below	801	824	827	809	2.8	0.4	-2.2
Dry	811	820	812	788	1.1	-1.0	-3.0
Critical	766	775	766	749	1.1	-1.0	-2.3
LAKE MCCLURE PROPOSED ACTION – APRIL							
WY Type	ELEVATION				PERCENT CHANGE		
	April	May	June	July	Apr-May	May-Jun	Jun-Jul
Wet	811	845	863	856	4.2	2.1	-0.9
Above	806	839	845	830	4.0	0.8	-1.8
Below	784	808	812	792	3.1	0.4	-2.4
Dry	794	804	795	768	1.2	-1.1	-3.4
Critical	748	758	750	731	1.3	-1.1	-2.4
LAKE MCCLURE NO-ACTION – MAY							
WY Type	ELEVATION				PERCENT CHANGE		
	April	May	June	July	Apr-May	May-Jun	Jun-Jul
Wet	812	845	863	856	4.1	2.1	-0.9
Above	817	848	853	838	3.8	0.7	-1.7
Below	801	824	827	809	2.8	0.4	-2.2
Dry	811	820	812	788	1.1	-1.0	-3.0
Critical	766	775	766	749	1.1	-1.0	-2.3
LAKE MCCLURE PROPOSED ACTION – MAY							
WY Type	ELEVATION				PERCENT CHANGE		
	April	May	June	July	Apr-May	May-Jun	Jun-Jul
Wet	811	844	863	855	4.1	2.2	-0.9
Above	809	834	846	826	3.0	1.5	-2.4
Below	789	806	810	790	2.1	0.4	-2.5
Dry	800	802	793	766	0.3	-1.1	-3.4
Critical	749	754	746	727	0.7	-1.1	-2.6

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### Chinook Salmon

Various life stages of fall-run chinook salmon can be present in the San Joaquin River Basin during all months of the year, although the number of individuals may vary considerably by stream and by year. Adults enter the system in October and spawn through January, with peak spawning period in November. Typically, eggs are buried in the spawning gravels for parts of November, December, and January, with occasional occurrences in October or February. Fry (very small juvenile fish) hatch starting in January, remain in the gravels for up to 30 days, and then emerge to feed and grow in shallow, slow moving water at the edge of the river. As the fry grow and develop (a process called rearing or maturation), they remain in waters which provide sufficient types and quantities of food and in waters where they can find cover from predators. At a certain stage of growth and development, they begin a process of physiological transformation to prepare for emigration out of the river to the ocean (smoltification). The majority of smolts leave the tributaries from March to the end of June. Other juveniles that remain in the tributaries and survive the summer months can become yearling smolts in the fall or winter.

Smolts can be stimulated to leave their rearing habitat by pulse flows in the spring. Pulse flows can mimic natural storm events that increase streamflow and stimulate emigration. Pulse flows usually result in increased turbidity and lower water temperatures. Both of these factors serve to reduce the impact of predation on emigrating smolts. Additionally, pulse flows may provide the necessary means to increase the survival of chinook salmon smolts by moving them out of tributaries in years when water temperature increases during the summer months result in elimination or reduction of suitable rearing habitat. The Vernalis Adaptive Management Plan is an experimental study to determine the proper level for the pulse flows.

**No Action.** The No Action alternative results in no changes to existing conditions. The No Action alternative includes fall attraction flow and spring pulse flow releases in accordance with the various operating plans, settlement agreements, and FERC requirements now in place for the San Joaquin River Basin and are intended to benefit adult and smolt life stages of chinook salmon. Since No Action represents the baseline, no impacts are identified for implementation of this alternative.

**Proposed Action.** In general, the Stanislaus, Tuolumne, and segments of the San Joaquin River (from the mouth of the Tuolumne to Vernalis) show less-than-significant changes in stream flow (Table 4.5-1A) as a result of implementing the proposed action. An exception to this general pattern occurs in October, January, and April/May. The relatively large increases in flow which occur in these reaches during October and/or April/May are viewed as beneficial impacts to fall-run chinook salmon. Increased stream flows in October benefit spawning adults migrating into the tributaries. These flows serve to attract the salmon to their natal streams. The spring pulse flow in April/May stimulates the emigration of salmon smolts out of the rivers systems toward the Delta and, eventually, the sea. The January increases occur in the Stanislaus River only and represent releases from storage of unallocated carryover for flood control purposes.

#### 4. Environmental Consequences and Mitigation Measures

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The Merced River and San Joaquin River (below the mouth of the Merced) show the same general flow patterns. However, large percentage increases in flow are observed when implementing the proposed action (Table 4.5-1A). This results from very low base case flows during October and April/May in some water year types. The large percentage increases shown for the Merced River in October for all water year types with the proposed action are due to increases in flow from base conditions of zero cfs. For example, in October during wet water year types, base flow conditions of zero cfs existed for 2 of the 17 years. In each case, these flows were increased to 203 cfs with the proposed action. Using a minimum flow of 1 cfs to allow for computation of percent increase, each of these years results in an increase of over 20,000 percent. When these values are used over the 17 wet water year types, the *average percent change* in flow is equal to 2,519.

The alternative to this method would have been to first calculate the average monthly flow by water year type and then determine the percent change between the No Action and proposed action alternatives. This method would have resulted in the *percent change in average flow* by water year type.

The selection criteria is based on the average percent change in flow between the no action and the proposed action. This is the preferred approach, since it is tightly linked to individual flow measurements and their relative accuracy. Statistically, the differences between meaningfully paired comparisons (i.e., proposed action minus no action) have a distribution similar to the original data which can be characterized by a variance and a mean. This transformation of the data (the process of calculating differences) preserves the information contained in the original data set. Consequently, the average percent change in flow is chosen as the criterion to assess impacts. This choice maintains the close, meaningful relationship between the selected assessment criteria and individual flow measurement.

Since base case flows are so low, the increased discharge into the Merced by the proposed project is considered a beneficial impact. The increases in flow in the San Joaquin River below the Merced are also considered a beneficial impact to the salmon. With no action, the Merced River has very low instream flow requirements. Since the proposed action provides most of the additional water needed to achieve the SJRA flows by releases into the Merced River, the fishery resources of this San Joaquin River tributary should benefit the most by implementation of the project. The operating conditions at the Merced River Fish Facility would not be impacted.

The Merced River also exhibits some reductions in flow associated with the proposed action (Table 4.5-1A). These occur in January through March, April (during a May release), May (during an April release), and in June. These instream flow reductions are the result of reservoir refill operations for Lake McClure and are largest in magnitude during above normal and wet water year types (maximum change of -22 percent). However, based upon the impact threshold criteria described in Section 4.5.1.2, these reductions in flow are considered to be less-than-significant impacts.

The October attraction and spring pulse flows associated with the proposed action are potentially large, rapidly increasing flows. These could create the potential for rapid increases and decreases in

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river height (stage) as the flows are implemented, producing circumstances which could dewater redds in the fall (a dewatered redd is a “nest” of salmon eggs, buried in gravel, that becomes exposed to air when the stage of a river is sufficiently decreased), or strand salmon fry and smolts during the spring (stranding is when fish living in shallow-water habitats near shore are trapped in dewatered areas, or isolated in pools outside of the river channel, after a sudden decrease in the stage of a river).

Another possible impact to a redd is for it to be scoured by an increase in flow large enough to cause movement of the gravel substrate. Scouring may result in the loss of eggs or fry developing within the gravels. Because of the possible magnitude of these flow changes under the proposed action, this is considered to be a potentially significant negative impact. A mitigation measure to reduce the impact to less than significant would be to control the down ramp so as to protect redds and fish within the system from dewatering and stranding. In coordination with U.S. Fish and Wildlife Service (USFWS) and California Department of Fish and Game (DFG), the Operations Group should develop and adopt a Best Management Practice (BMP) for supplying ramping guidelines (both up and down ramp) governing the release of attraction and pulse flows to ensure and maximize the protection of salmon. This BMP could be included in the annual operation plan. Additional water included in the SJRA from OID not specifically directed to the pulse flows could be used for ramping.

The October attraction flows may also stimulate adult salmon to enter spawning reaches where ambient water temperatures become too high after the attraction flow is reduced. The increased water temperature may result in reduced fecundity of females (fecundity is a measure of viable eggs produced by a female). The occurrence of this type of event would most likely take place in critical years when low flow releases are scheduled during November and seasonal air temperatures are high.

The impact of the proposed actions on these events is likely to be less than significant based on low frequency of occurrence for these events and the modeled flow predictions for November with the proposed action that show no significant changes in flow. Existing temperature models should be used in conjunction with habitat data to predict changes in temperature and usable habitat for various life stages of salmon based on a comparison of proposed flows versus no action.

Existing records, data, and modeling efforts addressing water temperature issues for the Merced River are not sufficient at this time to allow comprehensive quantitative analysis of the potential for impacts of the proposed actions on Merced River temperatures. However, a qualitative examination of projected changes in average monthly Lake McClure water storage levels provides a useful approach for understanding better the potential for impacts on river temperatures.

The storage level of Lake McClure is a primary factor affecting the temperature of water released into the Merced River at New Exchequer Dam. Along with season of the year, annual runoff pattern, and annual air temperature variations, reservoir levels affect the temperature of water at the dam’s outlet.

The level of the reservoir affects the volume of cold water in the hypolimnion which forms in the deepest layers of the reservoir upon thermal stratification during the late spring, summer, and

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early fall months. Surface water warmed by the air and solar radiation during the spring and summer “floats” on top of the cooler, denser water of the hypolimnion. The depth of this warmer surface layer can vary but is generally between 15 and 30 feet deep in most California reservoirs. Once thermal stratification breaks down during the early fall months, the warmer surface and cooler hypolimnion waters mix and reservoir temperature becomes almost uniform throughout its depth and comes to a dynamic equilibrium with inflow and air temperatures until stratification reoccurs in spring.

Given this general relationship between a lake’s temperature profile and depth, differences in lake level can be used as a proxy indicator for potential differences in temperature at the reservoir outlet. Figures 4.5-1 through 4.5-5 provide graphical representation of the differences in average monthly lake levels between the proposed action (April and May scenarios) and the No Project alternative. They suggest that minimal effects on the temperature of water released into the Merced River may be expected. The difference between the two proposed action operations is negligible. Differences between the proposed action (April and May scenarios) and No Project alternative are small. The magnitude of these differences vary between water year type and over the course of individual water years, but are generally less than 30 feet different in depth. Such a small difference between the alternatives, relative to total depth of the reservoir at any one time, would not be expected to have much effect on release temperature when compared to the No Project Alternative, except perhaps during the early fall months in dry and critically dry water years when total storage may be limited. The extent of such an impact on water temperature in the Merced River would be dependent on the degree of cooling provided by decreasing seasonal air temperature which dominates release temperature in affecting river temperature in the lower Merced River during the fall and early winter months.

**Alternative Action.** Flows for the alternative action are based on the SWRCB (1998) models (DWRSIM) previously discussed in Section 4.1.4. The aquatic resources impact analyses of the alternative action is based on percentage differences in flow between the SWRCB Alternative 3, known as the Water Right Priority System, as compared with SWRCB Alternative 2, used as comparable to the No Action alternative. By deriving the percentage change (Table 4.5-3) between the two SWRCB alternatives, the criteria developed in Section 4.5.1 can be employed to evaluate impacts and their significance. Available SWRCB data facilitates impact assessment for the major tributaries of the San Joaquin River, but not for the mainstem San Joaquin River.

For the alternative action, impacts to fall-run chinook salmon would not be significant, based on flow changes considered to be within measurement error ( $\pm 10$  percent), or measurable, but less-than-significant (between -11 percent and -25 percent) changes in flow. However, some potentially significant (greater than -25 percent) changes in flow are shown to occur in the Merced River during February and in the Stanislaus River during May (Table 4.5-3) of the SWRCB defined critically dry period (May 1923 to October 1934). The Stanislaus flow reductions may be the result of pulse flows being reduced in April/May. (Note that pulse flows modeled by SWRCB can cross months, whereas the pulse flows in the proposed action occur in either April or May). Based on available information,

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**Table 4.5-3: AVERAGE PERCENT CHANGE IN FLOW FOR SWRCB ALTERNATIVE 3 AS COMPARED WITH ALTERNATIVE 2 FOR MAJOR TRIBUTARIES OF THE SAN JOAQUIN RIVER OVER A 73-YEAR PERIOD AND A CRITICAL PERIOD (MAY 1928 TO OCTOBER 1934)**

	October	November	December	January	February	March	April	May	June	July	August	September
Stanislaus Flow, 73 Year	14.1	3.5	7.5	15.6	28.5	11.3	-14.3	-22.0	-1.5	-9.8	0.6	0.7
Stanislaus Flow, Critical	25.9	0.0	4.4	3.6	5.0	0.0	-18.7	-27.5	23.0	50.5	50.0	7.2
Tuolumne Flow, 73 Year	0.2	0.0	-1.8	-10.7	-8.0	-3.8	-0.3	4.5	35.5	3.3	0.0	0.0
Tuolumne Flow, Critical	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	243.6	0.0	0.0	0.0
Merced Flow, 73 Year	-5.8	-11.5	-11.4	-8.4	-14.9	-8.3	88.9	48.1	21.3	64.3	43.6	-4.6
Merced Flow, Critical	-22.3	0.0	-1.2	-17.8	-57.5	0.0	275.7	404.3	139.6	200.0	130.1	0.0

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it is not possible to determine whether mitigation would be required. The Merced flow reductions could adversely affect salmon fry at an early stage in their development when large reductions in flow would have the highest potential for stranding young fish. Possible mitigation could include adopting a BMP for ramping flow changes.

Large percentage increases in flow, that would provide potentially significant beneficial impacts occasionally occur in all rivers, mainly in the June through August period. However, no life stages of fall-run chinook salmon are known to be present in the Merced River during those months. The Merced River shows potentially beneficial increases in flow during April and May.

##### **Steelhead Trout**

Steelhead use the Stanislaus River in much the same way as fall-run chinook salmon, most of the impacts and model results discussed in the preceding section would apply to steelhead as well. The main differences between steelhead and fall-run chinook are: 1) adult steelhead begin their spawning migration slightly later than chinook and, therefore, stages of development for the eggs and juveniles will be approximately one month later than chinook; 2) adult steelhead will not necessarily die after spawning, resulting in some adults remaining in the rivers through June; and 3) young steelhead would likely remain in the rivers throughout their first summer.

**No Action.** The No Action alternative results in no changes to existing conditions. The No Action alternative includes flow releases for the Stanislaus River in accordance with the New Melones Interim Plan of Operation.

**Proposed Action.** The proposed action would result in aquatic resources impacts similar to those previously discussed for the fall-run chinook salmon in the Stanislaus River. No significant adverse changes would result in stream flow in the Stanislaus River as a result of implementing the proposed action. Beneficial impacts to steelhead would occur in the Stanislaus as a result of flow increases in October and April/May (Table 4.5-1A). These flow increases would provide attraction flows for immigrating adults in the fall, and pulse flows to stimulate emigration of smolts in the spring.

The same potentially significant impacts resulting from rapid changes in flow that may dewater or scour redds and strand juveniles would exist for steelhead. Mitigation would be the same as that described earlier for adopting Best Management Practices for ramping guidelines for pulse flows and including those in the annual operation plan.

Because yearling steelhead may reside in the Stanislaus during summer months, the Reclamation model for stream temperatures in the Stanislaus was used to identify any potential impacts that may occur during June through September as a result of implementing the proposed action. Output from the model showing the number of years water temperatures exceeding 68° F are predicted at the mouth of the river over a 70-year period (1922-1991) indicated that the maximum percent exceedence for the months of June through September, over all water year types, was reduced with

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the proposed action (April or May) by 1.4 percent. These findings are consistent with the changes in percent flow shown in Table 4.5-1A. The impact of temperature change is less than significant.

**Alternative Action.** For the alternative action, impacts to steelhead would be similar to those discussed for fall-run chinook salmon with no significant, or less-than-significant impacts in the Stanislaus River during most months. Potentially significant changes in flow would occur on the Stanislaus River in May (Table 4.5-3). Based on available information, it is not possible to determine whether mitigation would be required for the Stanislaus River.

Large percentage increases in flow, showing potentially beneficial impacts, occasionally occur in the Stanislaus mainly during the summer months of June through August, during the SWRCB defined critical period.

#### Striped Bass

Striped bass are an introduced, anadromous species that primarily occur and spawn within the Delta and the Sacramento River Basin. Striped bass may enter the San Joaquin River Basin as adults to spawn in spring months. They typically spawn in the freshwater habitats available in the northern Delta lower reaches of the Sacramento River and the San Joaquin River below Vernalis. Striped bass eggs are buoyant and carried by the current towards the Delta. The eggs hatch within 1-2 days, and the young fry continue to be carried by currents towards the Delta.

**No Action.** The No Action alternative results in no changes to existing conditions. The No Action alternative includes flow releases in accordance with the various operating plans, settlement agreements, and FERC requirements now in place for the San Joaquin River Basin with no specific management of flows to benefit striped bass.

**Proposed Action.** The proposed action would result in increased stream flows during the spawning period in April or May that could attract spawning adults into the San Joaquin River. Beneficial impacts are expected in dry and critical water years. The potential reduction of available spawning habitat in the Merced River in above normal and wet water years would be a less than significant impact with little or no cumulative effect, due to the very low frequency of spawning in this area.

**Alternative Action.** The alternative action would result in increased stream flows during the spawning period only in the Merced River. In the Stanislaus and Tuolumne rivers, spawning period flow changes are mainly reductions in flow that would be less than significant, based on average percent changes of less than -25 percent and the very low frequency of spawning in these rivers.

Potentially beneficial impacts from increased flows in the summer months may occur in offsite locations (within the Delta ) for maturing striped bass fry.

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### Splittail

Splittail enter the San Joaquin River Basin to spawn during the winter and spring months. They require shallow, near shore areas or inundated floodplains for spawning and juvenile rearing. The young then continue to rear in these areas for a period of a few weeks up to one year (Sommer et al. 1997). They are a native species found in the lower reaches of the San Joaquin River and its major tributaries and also occur in the Delta and the Sacramento River Basin.

**No Action.** The No Action alternative results in no changes to existing conditions. The No Action alternative includes flow releases in accordance with the various operating plans, settlement agreements, and FERC requirements now in place for the San Joaquin River Basin with no specific management of flows to benefit splittail.

**Proposed Action.** The proposed action would result in beneficial impacts to splittail as a result of increased stream flows during a portion of the spawning period in April or May. Beneficial impacts are expected in dry and critical water years. The impacts of potential reduction of available spawning habitat in the Merced River in above normal and wet water years would be less than significant with little or no cumulative effect, due to the low frequency of occurrence for these events.

**Alternative Action.** The alternative action would result in increased stream flows during the spawning period only in the Merced River. In the Stanislaus and Tuolumne rivers, spawning period flow changes would be less-than-significant. Potentially beneficial impacts from increased flows in the summer months would occur in all rivers during the SWRCB critically dry period, benefitting maturing splittail fry.

### Reservoir Species

The reservoir species selected as an indicator species for aquatic resources is the largemouth bass. Bass fishing is a very popular and economically important component of recreational use of reservoirs within the project area and throughout the state. Trophy sized largemouth bass are considered a prized gamefish. Largemouth bass spawn in April through June and eggs hatch in 5-10 days. The spawning period coincides with the period when reservoirs would be providing additional stream flows under the project. There is a possibility that reservoir levels would drop just after bass spawning and potentially impact the survival of the eggs. If reservoir levels increased after bass spawning, it would provide additional rearing habitat for the fry.

**No Action.** The No Action alternative results in no changes to existing conditions. The No Action alternative includes flow releases in accordance with the various operating plans, settlement agreements, and FERC requirements now in place for the San Joaquin River Basin. Fluctuation of reservoir levels occur to the extent required to meet these flow releases.

**Proposed Action.** The proposed project would coordinate releases from reservoirs on the three major tributaries of the San Joaquin River (New Melones, New Don Pedro, and Lake McClure). The

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relatively small amount of water required for spring pulse flows would not cause excessive drawdown of any of the reservoirs under any water year types. Based on modeled reservoir storage, converted to water surface elevation, for the April through July period, averaged by water year type (Table 4.5-2), Lake McClure, which would likely have the most impact, would have average water surface elevation changes of three feet or less. Based on criteria established in Section 4.5.1, no significant impacts would result from the implementation of the project.

**Alternative Action.** The alternative action is assessed based on an analysis using SWRCB (1998) Alternative 3, the State Water Right Priority System, compared with SWRCB Alternative 2 as the base case. The assessment utilizes the SWRCB (1998) criterion of relative percentage change in Average Reservoir Habitat Index for an alternative when compared to base conditions. This criterion states that an alternative is considered significant only if the index is more than 10 percent different than the index for the base case. The three reservoirs assessed are New Melones, New Don Pedro, and Lake McClure. Results are presented below in Table 4.5-4.

**Table 4.5-4: PERCENT CHANGE IN RESERVOIR HABITAT INDEX FOR SWRCB ALTERNATIVE 3 COMPARED WITH SWRCB ALTERNATIVE 2**

Reservoir	Alternative 2 Index (Base Case)	Alternative 3 Index (SWRP)	Percent Change (+/-)
New Melones	253	285	+12.6
New Don Pedro	358	339	-5.3
Lake McClure	387	366	-5.4

New Don Pedro and Lake McClure show changes that are not significant (less than 10 percent). New Melones shows significant beneficial impacts (greater than 10 percent) for the State Water Right Priority System alternative action (Alternative 3).

#### **Delta smelt and longfin smelt**

These species occur exclusively in the Delta, downstream of Vernalis. As stated in the 1995 Biological Opinion for the protection of delta smelt (USFWS 1995):

Proposed operations of the CVP and SWP provide adequate flows to transport delta smelt away from the influence of the pumps and provide productive, low-salinity rearing habitat in Suisun Bay. Flows for these purposes are needed from February to the end of June during most years. Because delta smelt are weak swimmers as larvae, they are passively transported with flows. Therefore, during the larval phases, flows of sufficient magnitude and duration are needed to transport and disperse delta smelt from the Delta to Suisun Bay. Bruce Herbold (EPA, pers. comm., 1994) has found a positive correlation between Delta outflow and delta smelt abundance as measured

#### 4. Environmental Consequences and Mitigation Measures

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by the fall midwater trawl index when X2 is between Middle Ground Shoals and Roe Island.

The operation of the Old River Barrier is based on VAMP sampling objectives. The Service issued a Formal Endangered Species Consultation and Conference on the Proposed South Delta Temporary Barrier Project for 1996 through 2000 (USFWS 1996b). They concluded that “the proposed continuation of the Temporary Barriers Project will likely adversely affect delta smelt and Sacramento splittail, and adversely modify or destroy delta smelt critical habitat, both directly and indirectly.” However, the Service also concluded that the temporary installation of the rock barriers are not likely to jeopardize the continued existence of the delta smelt and the proposed Sacramento splittail, or result in the destruction or adverse modification of critical habitat for delta smelt because the impacts are temporary in nature, there are several protective measures in place to reduce the effects of the project, and there will be overall integration of this project with CVP/SWP operations and the Operations Group (USFWS 1996b). The operational status of this fish control structure may be influenced by take limits of delta smelt at the export facilities.

**No Action.** The No Action alternative results in no changes to existing conditions. The No Action alternative includes flow releases in accordance with the various operating plans, settlement agreements, and FERC requirements now in place for the San Joaquin River Basin. Operations in the Delta would continue in accordance with the Delta Smelt Biological Opinion.

**Proposed Action.** The proposed action results in increased flow from the San Joaquin River into the Delta. The ratio of the total flows entering the Delta to the amount of flow exported, along with the operational status of the fish control structure at the head of Old River, determines the impacts to delta and longfin smelt. Since the operation of these facilities with project flows would be done in accordance with the 1995 Delta Smelt Biological Opinion and the 1996 temporary barriers consultation, less-than-significant impacts to delta smelt would result by implementing the proposed flow action.

**Alternative Action.** The alternative action results in increased flow from the San Joaquin River into the Delta, with no operational barrier at the head of Old River. The ratio of the total flows entering the Delta to the amount of flow exported determines the impacts to delta and longfin smelt. Since the operation of the export facilities would be done in accordance with the 1995 Delta Smelt Biological Opinion and the 1996 temporary barriers consultation, less-than-significant impacts to delta smelt would result by implementing the alternative action.

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### 4.5.3 Impact Summary and Mitigation of Impacts

#### 4.5.3.1 Habitats and Ecological Zones

##### Proposed Action

- No criteria exists for assessing impacts to Ecological Zones, no determination of significance can be made. No mitigation proposed.

##### Alternative Action

- Not possible to evaluate impacts at the Ecological Zone level of biological organization. No mitigation proposed.

#### 4.5.3.2 Factors Affecting the Distribution and Abundance of Aquatic Resources in the San Joaquin River Basin and Bay/Delta Estuary

##### Proposed Action

- The only factor directly impacted by the project is water quality. Implementation of the proposed action positively benefits water quality and would, therefore, not adversely affect aquatic resources. No mitigation is required.

##### Alternative Action

- The only factor directly impacted by the project is water quality. Implementation of the alternative action positively benefits water quality and would, therefore, not adversely affect aquatic resources. No mitigation is required.

#### 4.5.3.3 Indicator Species

##### Chinook Salmon

##### Proposed Action

- In general, the proposed action results in flow changes for the Stanislaus, Tuolumne, Merced, and San Joaquin rivers that are considered to be not measurable, or measurable with less-than-significant impacts to fall-run chinook salmon. No mitigation is required.
- During the spring (April/May) and fall (October), the proposed action results in increased flows for the Stanislaus, Tuolumne, Merced, and San Joaquin rivers that would result in beneficial impacts to emigrating salmon smolts and immigrating adults. No mitigation is required.

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- The increased flows in spring and fall may also produce potentially significant impacts to juvenile salmon and salmon redds, depending on the implementation of the flows. Sudden decreases may strand juveniles, and large magnitude changes may result in dewatering or scouring of redds. Mitigation would be to implement ramping of flows to ensure that adverse impacts are avoided, and water for ramping is included in the SJRA. With mitigation, the impact is less than significant.
- Impacts to female fecundity based on high November water temperatures following October pulse flows are likely to be less than significant based on the low frequency of occurrence of the event and modeled flow predictions that show no significant changes in flow. No mitigation is required.
- Minimal effects from reduced water levels in Lake McClure and water releases into the Merced River on the temperature in the river may be expected, except in dry and critically dry water years when total storage may be limited. The degree of cooling provided by decreasing seasonal air temperature dominates release temperature, so the project impact is less than significant.

#### **Alternative Action**

- In general, the alternative action results in changes in flow for the Stanislaus, Tuolumne, Merced, and San Joaquin rivers that result in less-than-significant impacts to salmon. No mitigation is required.
- The alternative action results in flow reductions on the Merced River in February and the Stanislaus River in May during the SWRCB defined critically dry period that result in potentially significant impacts to juvenile salmon. Mitigation could include increased smolt production from the Merced River Fish Facility.

#### **Steelhead**

##### **Proposed Action**

- Steelhead are found only in the Stanislaus River and impacts are limited to the Stanislaus River. Beneficial impacts to steelhead would occur as a result of flow increases during most months, in all water year types. No mitigation is required.

##### **Alternative Action**

- The alternative action would result in less-than-significant impacts to steelhead in the Stanislaus River during most months. No mitigation is required.

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- Flow reductions in the Stanislaus River shown to occur in May during the SWRCB defined critically dry period could result in potentially significant impacts to juvenile steelhead. Mitigation could include smolt production from the Merced River Fish Facility.
- Large percentage increases in flow occur occasionally during summer months in the Stanislaus River, primarily during the SWRCB defined critically dry period, and would be beneficial to over-summering juveniles. No mitigation is required.

#### **Striped Bass**

##### **Proposed Action**

- The proposed action would result in increased flows during the spawning period for striped bass and provide beneficial impacts, especially during dry and critical water year types. No mitigation is required.
- The potential reduction of available spawning in the Merced River during above normal and wet water year types as a result of reduced flows is a less-than-significant impact. No mitigation is required.

##### **Alternative Action**

- The alternative action would provide increased stream flows during the spawning period only in the Merced River, a beneficial impact. Flow reductions in the Stanislaus and Tuolumne rivers during the spawning period result in less-than-significant impacts to striped bass. No mitigation is required.
- Potentially beneficial impacts from increased flows in the summer months may occur in offsite locations (within the Delta ) for maturing striped bass fry.

#### **Splittail**

##### **Proposed Action**

- The proposed action would result in increased flows during the spawning period for splittail and provide beneficial impacts, especially during dry and critical water year types. No mitigation is required.
- The potential reduction of available spawning in the Merced River during above normal and wet water year types as a result of reduced flows is a less-than-significant impact. No mitigation is required.

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### **Alternative Action**

- The alternative action would provide increased stream flows during the spawning period only in the Merced River, a beneficial impact. Flow reductions in the Stanislaus and Tuolumne rivers during the spawning period result in less-than-significant impacts to splittail. No mitigation is required.
- Potentially beneficial impacts to young splittail result from increased flows that occur in the summer months in all rivers during the SWRCB defined critically dry period. No mitigation is required.

### **Reservoir Species**

#### **Proposed Action**

- No significant impacts to largemouth bass would result from the implementation of the proposed action. No mitigation is required.

#### **Alternative Action**

- Less-than-significant impacts to reservoir habitat for New Don Pedro and Lake McClure occur as a result of the alternative action. No mitigation is required.
- Beneficial impacts to reservoir habitat for New Melones occurs as a result of the alternative action. No mitigation is required.

### **Delta smelt and longfin smelt**

#### **Proposed Action**

- No significant impact to delta and longfin smelt would occur during the increased spring and fall pulse flows provided by the proposed action along with compliance of the 1995 Biological Opinion for the operation of the CVP and SWP.

#### **Alternative Action**

- No significant impact to delta smelt would occur during the increased flows provided by the alternative action along with compliance of the 1995 Biological Opinion for the operation of the CVP and SWP.

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