CHAPTER 5
Climate Change

This chapter provides an overview of the climate change scenarios developed by the California Water Commission (CWC) and how a changed climate may change the long-term impacts and benefits of the Phase 2 Expansion. An analysis of how each alternative may change greenhouse gas emissions can be found in the Air Quality Section 4.10. The CWC requires that applicants evaluate their storage project under two specific climate change scenarios for the years 2030 and 2070 (Section 6004 of Water Storage Investment Program). Consideration of climate change is required in the quantification of public benefits of water storage projects to comply with Executive Order B-30-15 (2015) and Assembly Bill 1482 (2015), which require state agencies to account for climate change in project planning and investment decisions. Two CalSim II models with projected future changes in rainfall, runoff, sea-level rise, SWP and CVP operations for the years 2030 and 2070 were developed by the CWC and are used to evaluate the Phase 2 Expansion benefits and impacts. Other aspects of climate change such as changes in atmospheric CO2, humidity, wind and solar radiation are not explicitly included in the CalSim II models but could affect environmental conditions.

5.1 Overview of Climate Change Modeling

CWC staff worked with DWR's Climate Change Technical Advisory Group (CCTAG) to select 20 scenario-model combinations that are most appropriate for California water resource planning and analysis (DWR, 2015). The 20 climate scenario-model combinations were composed of 10 global climate models (GCMs) run with two emission scenarios, one optimistic (RCP 4.5) and one pessimistic (RCP 8.5). The results of the 20 climate scenario-model combinations were used to create ensemble projections for 2030 and 2070. The ensemble projections for the 2030 future and 2070 future conditions are summarized in Table 5-1.

The ensemble scenario developed for the year 2030 was used to evaluate the impacts (Section 4.2 and 4.3) and benefits (Chapter 3) of the Phase 2 Expansion. CCWD demands projected for the year 2030 assume full build out within CCWD's service area and includes the appropriate per capita demands for all of the planned development. The 2030 level of projected demands are conservative and are assumed to remain constant after 2030 for the lifetime of the project. This chapter also provides a sensitivity analysis of how the impacts and benefits of the Proposed Project, Alternative 1B, would change given the ensemble scenario projected for the year 2070. A sensitivity analysis was performed for the Proposed Project rather than for all alternatives because the changes in impacts and benefits associated with the Phase 2 Expansion are an order of magnitude smaller than the changes due to the change in the projected hydrology and sea-level (see Tables 5-3, 5-4, 5-5, 5-6). The change due to the action alternatives at 2070 are expected to

be similar to the results of the 2030 analysis. The sensitivity analysis at 2070 is considered in the cumulative effects analysis contained in Section 4.2, and 4.3.

Changes in runoff and stream flow were simulated by the CWC given the changes expected in temperature and precipitation for the ensemble scenarios at the years 2030 and 2070. The simulated changes in runoff were propagated to the CalSim II inflows, water year types, and other hydrologic indices that govern water operations, or compliance requirements are adjusted to be consistent with the new hydrologic regime. To simulate operations decisions based on compliance with salinity objectives in the Delta, CalSim II relies on an Artificial Neural Network (ANN) to estimate Delta salinity and the response of Delta salinity to changes in river flows. Two new ANNs were developed for the sea level rise projections at 2030 and 2070 and incorporated in CalSim II. Technical details and information regarding the development of the climate change projections is available in the Technical Reference Guide provided by the CWC (CWC, 2016).

The Bureau of Reclamation has also evaluated climate change impacts to the Central Valley Project and State Water Project in the Sacramento and San Joaquin Basin Study (Reclamation, 2016). The methodology for evaluating climate change and the performance of the CVP and SWP differs from the methodology used by the CWC. One key difference between the two is number of potential future climate projections evaluated. The Sacramento San Joaquin Basin Study evaluated three social-economic scenarios with six future climate projections, with changes in hydrology ranging from wetter to drier than existing conditions, for a total of 18 future scenarios. The CWC created a single ensemble projection which indicated that California could be warmer and wetter on average. The Sacramento San Joaquin Basin Study evaluated a wider range of climate projections than what is required by the CWC. If the future is warmer and drier than what has been projected by the CWC, the performance of the CVP and SWP could be more dire than what is presented in this chapter. Also included in Reclamation's studies, a wetter future with less warming might result in future conditions that are not so different from existing conditions.

The results of the CWC modeling are compared to those of the Sacramento San Joaquin Basin Study to provide context and highlight the potential uncertainty of the specific future projections developed by the CWC. Despite differences in the methodologies, the CWC climate change modeling tools indicate similar results to the central tendency scenario evaluated in the Sacramento San Joaquin Basin Study.

5.2 Potential Changes to California's Water Resources

Global climate change will affect water resources in California. Rising temperatures will alter the timing and amount of precipitation and will increase sea levels along the coast. Warmer temperatures could result in more of California's precipitation occurring as rain rather than snow, and snowmelt from the Sierra Nevada Mountains and Cascades is expected to shift earlier into the spring. The CVP and SWP supplies are dependent on snow pack in, and runoff from, the Sierra Nevada Mountains and the Cascades. Changes in local precipitation and hydrology could also affect natural recharge to the local groundwater aquifers and the quantity of groundwater that could be pumped sustainably over the long-term in some areas. Warmer temperatures could also lead to an increase in customer demand for water. Increased outdoor landscape and agricultural

irrigation, increased evaporative losses, and a longer growing season are expected to contribute to increased demands.

Except under the wettest potential future climate conditions, projected sea level rise could increase seawater intrusion into the Delta, thus increasing Delta salinity. Increased Delta salinity could reduce water supplies in two ways: 1) Delta water may need to be blended with other less salty sources to achieve water quality delivery goals, 2) CVP and SWP supplies may be reduced because they are required to meet water quality objectives at various locations in the Delta as defined by the State Water Resources Control Board Decision 1641 (D-1641). Increased Delta salinity could necessitate a reduction in Delta exports or increased releases from upstream reservoirs to meet the regulatory water quality objectives. Rising sea level could also increase the risk of levee failure in the Delta and therefore increase the risk of water supply disruption for CCWD, Local Agency Partners, and the Refuges.

5.2.1 Temperature and Precipitation

The climate change scenarios generated by the CWC generally indicate that temperatures would be warmer across the state; on average, temperatures are projected to increase by 2.3 degrees and by 5.3 degrees Fahrenheit by 2030 and 2070 respectively. There would be an overall increase in total precipitation in the northern part of the state but more of it would fall as rain rather than snow; on average, precipitation is projected to increase by 2.4 percent and by 4.6 percent by 2030 and 2070 respectively. The results of the temperature and precipitation projections are summarized in **Table 5-1**.

TABLE 5-1
PROJECTED CHANGES IN STATEWIDE AVERAGE CONDITIONS FOR 2030 AND 2070

2030 Future		2070 Future	
Average Precipitation Change (%)	**Average Temperature Increase (degrees F)**	**Average Precipitation Change (%)**	**Average Temperature Change (degrees F)**
2.4%	2.3	4.6%	5.3

In the Sacramento San Joaquin Basin Study, the projected increases in annual average temperature in the Central Valley basins relative to the historical period ranged from approximately 3.1 degrees Fahrenheit in the early 21st century to 7 degrees Fahrenheit by late-century for the central tendency projection. The CWC temperature projections are within the range of those evaluated in the Sacramento San Joaquin Basin Study. In the Sacramento San Joaquin Basin Study, the projected changes in precipitation in the Sacramento Valley watershed ranged from a decrease of 8.9% to an increase of 15% for the mid-century period from (2030 – 2070) and from a decrease of 8.3% to an increase of 19.4% near the end of the century (2070 -2100).

5.2.2 Snowpack, Runoff

Snow is projected to melt earlier in the year in the CWC climate change scenarios, shifting the peak runoff time earlier by several months in most years. **Figure 5-1** shows the change in runoff into the major reservoirs in the Sacramento River watershed projected for the year 2030 compared to the

Existing Conditions; winter runoff would increase by 1.4 million acre-feet while spring and summer runoff would decrease by 1.1 million acre-feet. Similarly, **Figure 5-2** shows the change in runoff into the major reservoirs in the Sacramento River watershed projected for the year 2070 compared to the Existing Conditions; winter runoff would increase by 2.1 million acre-feet per year on average whereas spring and summer runoff would decrease by 1.6 million acre-feet.

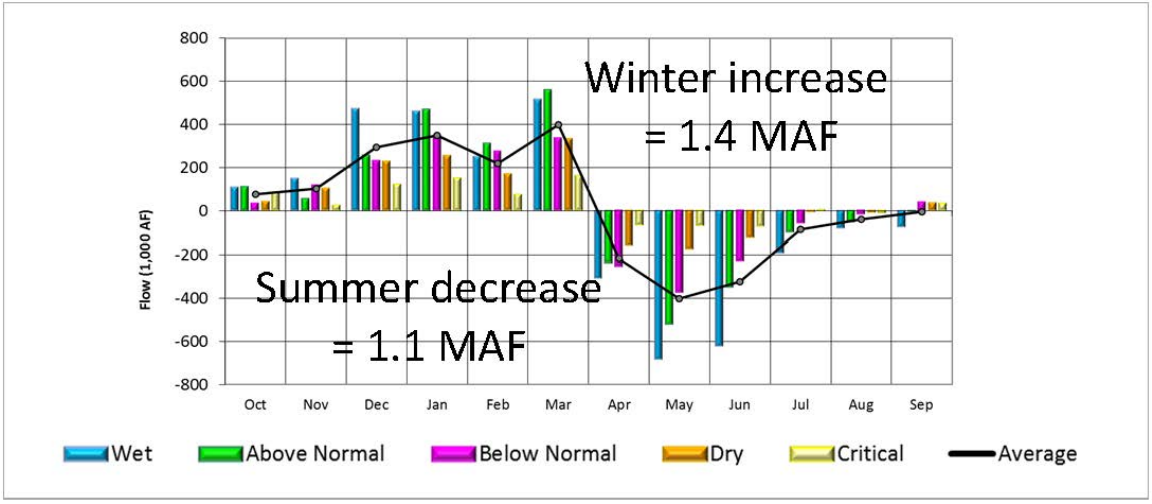


Figure 5-1
Change from Existing Conditions in Total Inflows to Shasta, Oroville, Trinity, and Folsom Reservoirs under 2030 Climate Change Scenario

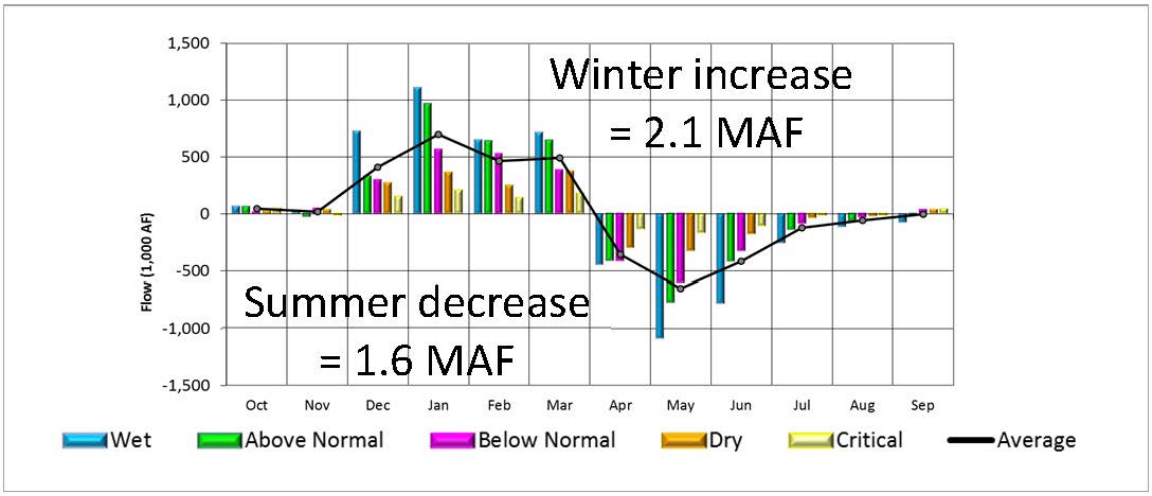


Figure 5-2
Change from Existing Conditions in Total Inflows to Shasta, Oroville, Trinity, and Folsom Reservoirs under 2070 Climate Change Scenario

Similar to the CWC scenarios, the Sacramento San Joaquin Basin Study found that more runoff would occur earlier in the winter and would be reduced later in the spring and summer. The drier warmer scenarios showed that there would be an overall decrease in runoff while the warmer wetter scenarios showed that there would be an overall increase in runoff. In the central tendency climate

scenario, average annual runoff was only slightly less than the no climate change condition. However, the drier climate scenarios had average annual runoff that was 19 to 26 percent less than the no climate change scenario, and the wetter climate scenarios had average runoff that was 16 to 22 percent greater than the no climate change scenario.

5.2.3 Sea Level Rise

Sea level worldwide has increased by 17 to 21 centimeters (cm) in the past century (IPCC, 2013). It continues to rise due to a combination of melting glaciers and ice sheets and thermal expansion of seawater as it warms. The CWC projects that sea level would rise by 15-cm and 45-cm in 2030 and 2070 respectively (**Table 5-2**). These sea-level rise projections are used in the CalSim II and DSM2 models. As sea level rises, salinity intrusion may increase in the Delta, thus requiring more freshwater flows into the Delta to maintain compliance with water quality objectives.

TABLE 5-2
PROJECTED CHANGES IN STATEWIDE CONDITIONS FOR 2030 FUTURE AND 2070 FUTURE

	2030 Future	2070 Future
Sea Level Rise at the Golden Gate	15 cm	45 cm

The Sacramento San Joaquin Basin Study used the results from National Research Council study of west coast sea level rise and assumed that the sea-level rise as measured at the Golden Gate Bridge in San Francisco, would range from 4.3 to 29.7 cm by 2030, with a projected mean of 14.4 cm. By 2050, the sea level rise would from 12.3 to 60.8 cm, with a projected mean of 28.0 cm. By the end of the century, the sea level rise would range from 42 to 166 cm, with the mean being 91.9 cm. The sea-level rise projections used by the CWC are within the range evaluated in the Sacramento San Joaquin Basin Study and the mean projections in 2030 are similar.

5.3 Potential Changes to California's Water Management

The projected changes in temperature, precipitation, runoff patterns, sea-level rise and water demands in both 2030 and in 2070 would influence the operation of the CVP and SWP reservoirs and export facilities. The operation of these facilities, in turn, influence Delta flows, water quality, river flows, and reservoir storage.

5.3.1 Performance of Central Valley Project and State Water Project under Climate Change

Although there would be more precipitation overall in future climate scenarios provided by the CWC, more of it would fall as rain during the winter. This would necessitate an increase in flood releases during the winter and reduce reservoir storage levels throughout the rest of the year. Without climate change, total CVP and SWP carryover storage would be 7,400 thousand acre-

feet [TAF] on average, with the climate change projected for 2030, total carryover storage would be reduced to 6,778 thousand acre-feet, and with the climate change projected for 2070, total carryover storage would be reduced to 6,118 thousand acre-feet. **Figure 5-3** and **Figure 5-4** show changes in carryover storage for Shasta and Oroville reservoirs for the 2030 and 2070 climate change scenarios. Without climate change, total CVP deliveries would be 4,688 thousand acre-feet on average and SWP deliveries would be 2,636 thousand acre-feet on average. With climate change projected in 2030, total CVP deliveries would be reduced to 4,527 thousand acre-feet and SWP deliveries would be reduced to 2,611 thousand acre-feet. With climate change projected in 2070 total CVP deliveries would be reduced further to 4,184 thousand acre-feet and SWP deliveries would be reduced to 2,427 thousand acre-feet. **Table 5-3** provides a summary of changes in CVP and SWP deliveries and carryover storage.

TABLE 5-3
SUMMARY OF CVP AND SWP PERFORMANCE UNDER CLIMATE CHANGE (ALL YEARS)

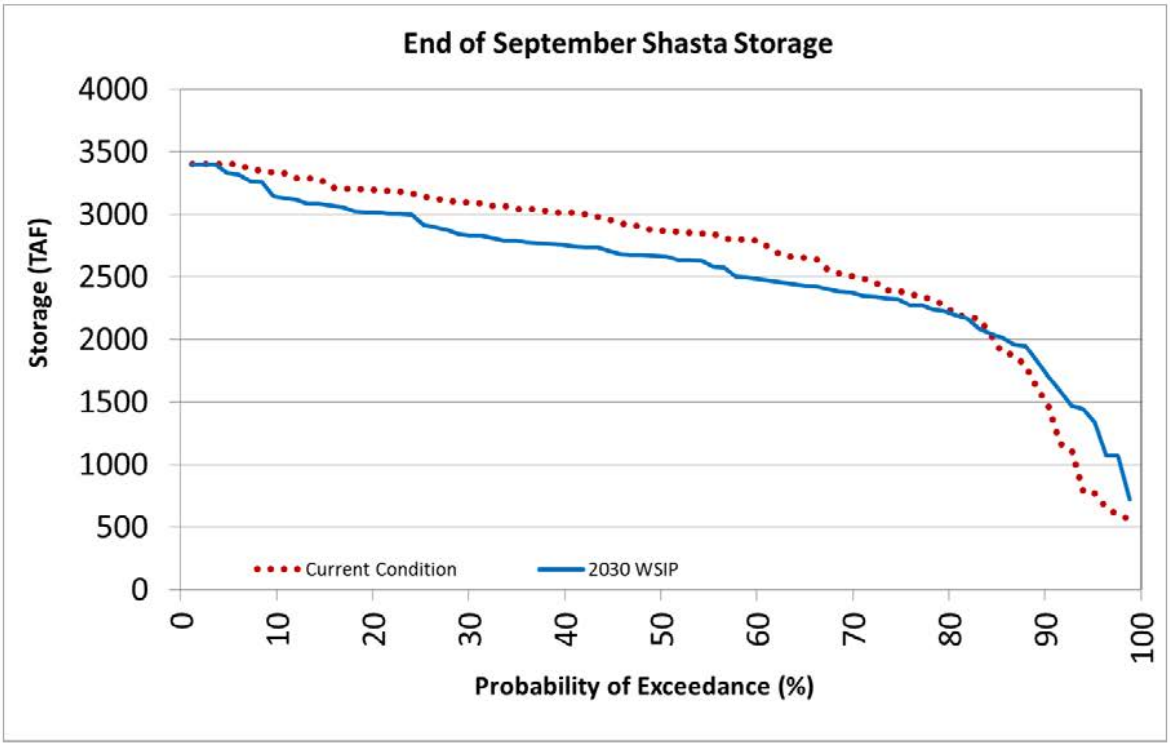
	Annual CVP Deliveries[1] [TAF]	Annual SWP Deliveries[2] [TAF]	CVP and SWP Carry-over Storage[3] [TAF]
Future, without Climate Change	4688	2636	7400
Future, with Climate Change 2030	4527	2611	6778
Future, with Climate Change 2070	4184	2427	6118

NOTES:
1 Total CVP deliveries include total agricultural, refuge, municipal and industrial deliveries.
2 Total SWP deliveries include Table A, Article 56 and Article 21
3 CVP and SWP carry-over storage includes storage in Shasta, Trinity, Oroville, Folsom and San Luis reservoirs.

TAF = thousand-acre foot (feet)

The Sacramento San Joaquin Basin Study did not include an evaluation total deliveries but rather included an analysis of unmet demands. The central tendency scenario showed unmet demands ranging from 7,470 to 7,572 TAF/year. The warmer and drier scenario had much greater increases in demand and reductions in supply, with unmet demands ranging from 8,753 to 8,914 TAF/year. Conversely, the less warming and wetter scenario had lower demands, higher supplies, and, consequently, lower unmet demands, with unmet demands ranging from 6,188 to 6,275 TAF/year.

The Sacramento San Joaquin Basin Study found that there was little change in carryover storage for the central tendency scenario compared to the no climate change scenario. Storage levels in both May and September were higher under the wetter climate scenarios compared to the no climate change scenario. Conversely, the storage levels in both months were lower under the drier climate scenarios compared to the no climate change scenarios.



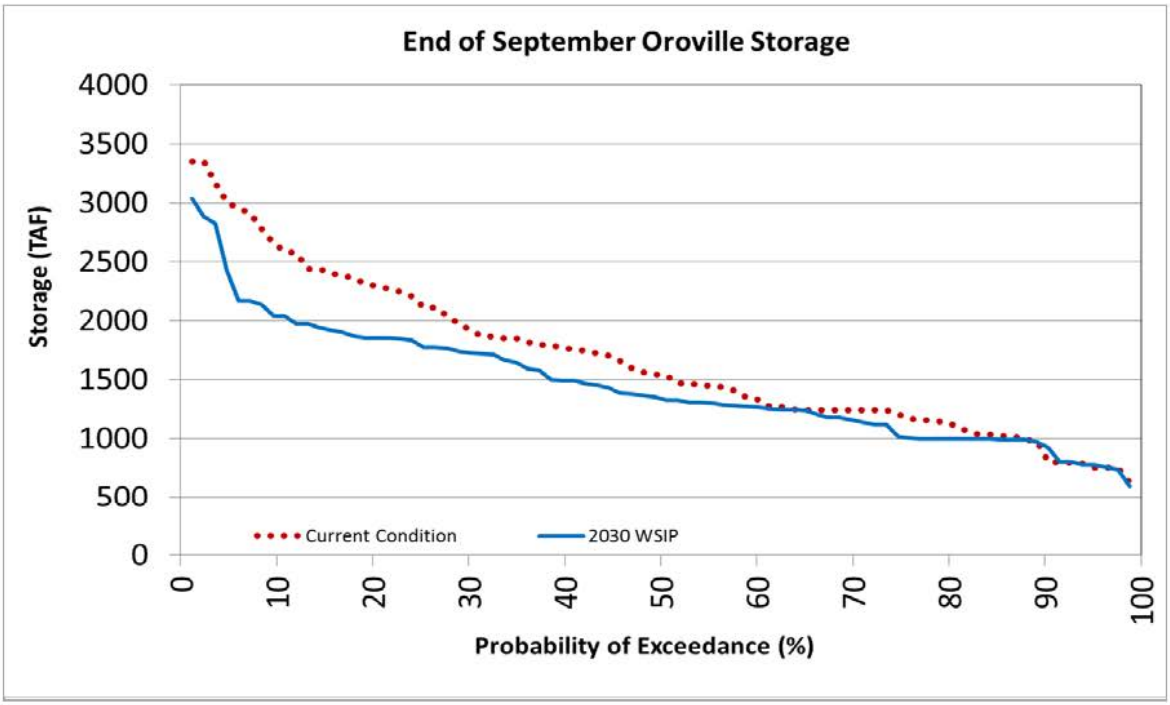
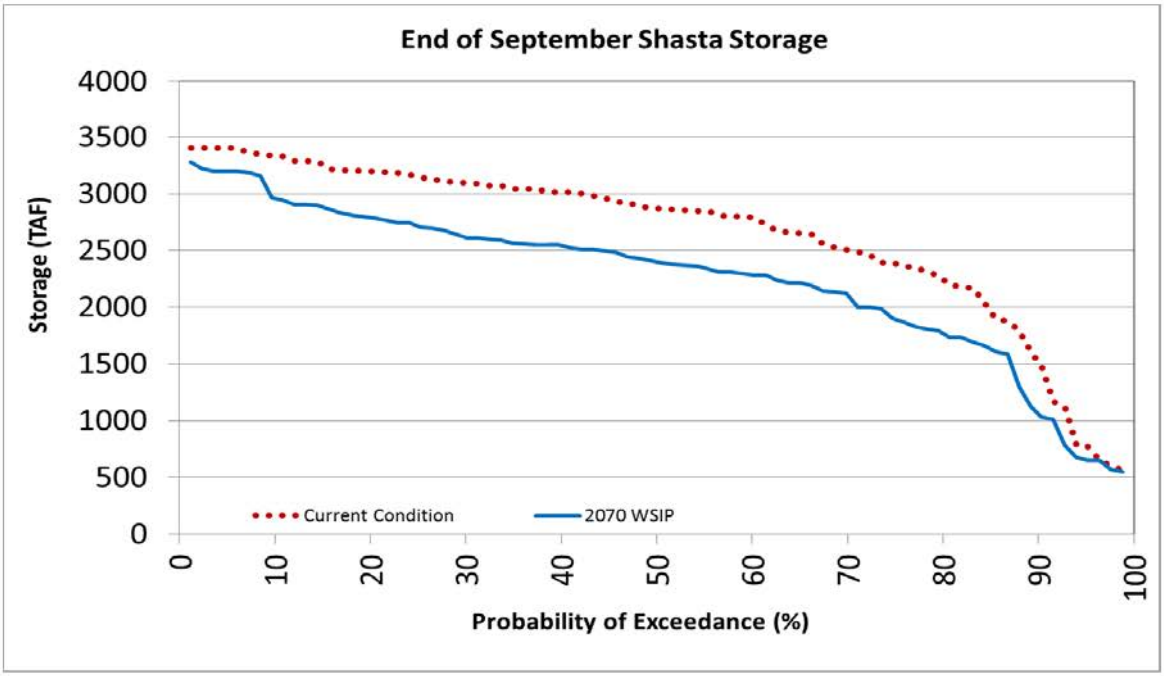


Figure 5-3
Change from Existing Conditions in Carryover Storage in Shasta and Oroville under 2030 Climate Change Scenario



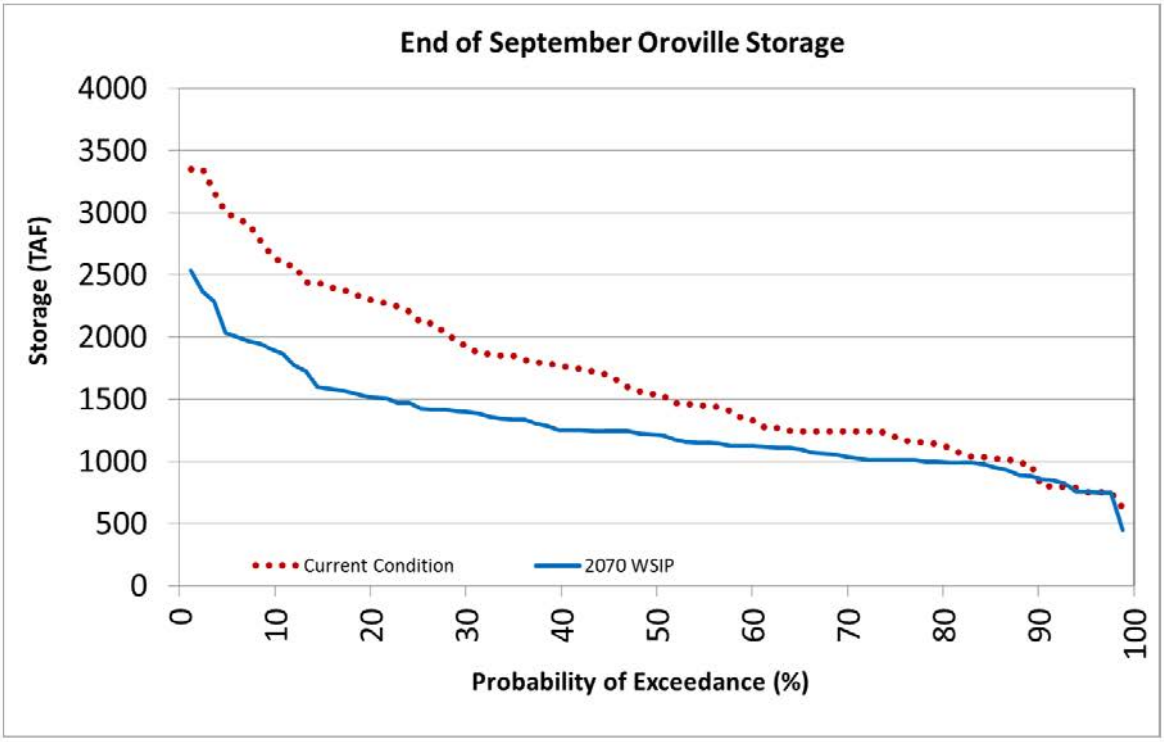


Figure 5-4
Change from Existing Conditions in Carryover Storage in Shasta and Oroville under 2070 Climate Change Scenario

5.3.2 Delta Hydrology and Hydrodynamics

The CWC climate change scenarios predict that inflows to the Delta would increase as would Delta outflow. The X2 position would remain similar, 74 kilometers (km) on average, under the 2030 climate change scenario compared to the future without climate change but would increase to 76 km by 2070 with climate change. The Export/Inflow ratio would decrease slightly because Delta inflow increases and because CVP/SWP deliveries decrease with climate change. Old and Middle River flows increase slightly (are less negative) under climate change. **Table 5-4** shows a summary of changes to key hydrologic and hydrodynamic metrics.

TABLE 5-4
SUMMARY OF DELTA HYDROLOGY AND HYDRODYNAMIC METRICS

	Delta Inflow[1] [cfs]	Delta Outflow [cfs]	X2 Position [km]	Export: Inflow Ratio	OMR[2] [cfs]
Future, without Climate Change	30285	21872	74	0.31	-2666
Future, with Climate Change 2030	31563	23370	74	0.31	-2214
Future, with Climate Change 2070	32469	24909	76	0.27	-1806

NOTES:
1 Includes flows from Sacramento River and San Joaquin River
2 Dec-Jun for all years. Positive percent increase indicates a potential environmental benefit as OMR is regulated as a negative number

In the Sacramento San Joaquin Basin Study, the wetter scenarios showed X2 position would not move farther eastward. The X2 position results under the wetter climate scenarios was similar to the no climate change scenario because the increased flows into the Delta in those wetter scenarios compensated for the increased sea level rise. However, the X2 position was greater under the central tendency and the drier scenarios where sea level rise combined with reduced Delta inflows relative to the no climate change scenarios resulted in greater X2 positions. The largest values occurred under the drier scenario, which also had the highest rate of sea level rise; under this scenario the average X2 position from February through June under was about 9–10 km farther east than under the no climate change scenario.

5.3.3 Delta Water Quality

Delta water quality standards are established by the SWRCB in the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary. The Water Quality Control Plan sets flows and salinity standards throughout the Delta which the CVP and SWP are largely responsible for meeting. Changes in salinity at a select group of compliance locations were evaluated: Rock Slough, Emmaton, Jersey Point, Brandt Bridge, Old River near Middle River, and Old River near Tracy Bridge. The numerical values of the standards at these locations are shown in **Table 4.2-21**.

In general, the number of potential water quality standards violations would increase with the climate change. Emmaton shows the greatest increase in the number of potential violations. This is likely due to greater seawater intrusion into the Delta combined with changes in hydrology that result in a decrease in reservoir storage and reduced Delta inflows in the summer and fall.

TABLE 5-5
SUMMARY OF THE FREQUENCY OF POTENTIAL WATER QUALITY STANDARDS VIOLATIONS

	Rock Slough [days]	Sacramento River at Emmaton [days]	San Joaquin River at Jersey Pt [days]	San Joaquin at Brandt Bridge [days]	Old River near Middle River [days]	Old River at Tracy [days]
Future, without Climate Change	**3.9**	**3.9**	**17.2**	**5.8**	**5.8**	**5.8**
Future, with Climate Change 2030	**15.0**	**11.5**	**18.3**	**5.2**	**5.3**	**6.0**
Future, with Climate Change 2070	**9.8**	**17.3**	**12.7**	**6.3**	**6.9**	**7.0**

The Sacramento San Joaquin Basin Study showed that salinity at Jersey Point and Emmaton would increase for all of the scenarios evaluated due to sea level rise. Salinity at Emmaton and Jersey point would increase between 18 to 23 percent by mid-century and by 65 to 88 percent by the end of the century. The central tendency scenario showed salinity increasing by 16 percent at Rock Slough on average. For the wetter scenarios, salinity at Rock Slough increased by a mere 0.5 percent, for the drier scenarios salinity increased by 36 percent relative to the no climate change scenario.

5.4 Performance of Alternative 1B under Climate Change

Changes to Delta hydrology and water resource management due to the projected climate change scenarios are far greater than changes due to the Phase 2 Expansion Alternative 1B. Changes in CVP and SWP deliveries, Delta inflows, and net Delta outflow due to climate change alone are an order of magnitude larger than the changes due to the Phase 2 Expansion Alternative 1B. CCWD demand projections are based on projected changes in population, implementation of regulations, passive and active conservation, the local economy and weather. CCWD demands projected for the year 2030 are consistent with the demands presented in the 2015 UWMP. The demands have been increased to account for the projected changes in population, conservation, economy and weather for the 2070 simulation.

5.4.1 Potential Changes in Water Deliveries to Others (CVP/SWP Performance)

Alternative 1B would not change CVP deliveries, and minimally change SWP deliveries, under the climate change scenarios evaluated. Also, Alternative 1B would not affect carryover storage. Alternative 1B would not adversely alter water deliveries to other users under the 2030 and 2070

climate change scenarios. **Table 5-6** shows changes in CVP and SWP deliveries and changes in carryover storage due to the implementation of Alternative 1B.

TABLE 5-6
INCREMENTAL PHASE 2 EXPANSION COMPARED TO THE 160 TAF NO PROJECT/NO ACTION ALTERNATIVE
SUMMARY OF CHANGES USED TO EVALUATE WATER DELIVERY TO OTHER USERS (ALL YEARS)

	Annual CVP Deliveries[1] [TAF/year]	Annual SWP Deliveries[2] [TAF/year]	CVP and SWP Carry-over Storage[3] [TAF]
Future, with Climate Change 2030[4]	**4527**	**2611**	**6778**
Percent Change under Alt 1B [4]	0.0%	0.0%	0.0%
Future, with Climate Change 2070	**4184**	**2427**	**6118**
Percent Change under Alt 1B	0.0%	-0.1%	0.0%

NOTES:
1 Total CVP deliveries include total agricultural, refuge, municipal and industrial deliveries.
2 Total SWP deliveries include Table A, Article 56 and Article 21
3 CVP and SWP carry-over storage includes storage in Shasta, Trinity, Oroville, Folsom and San Luis reservoirs.
4 Results from Table 4.2-8 & are repeated here for comparison to the Future, with Climate Change 2070 condition

TAF = thousand-acre foot (feet)

5.4.2 Potential Changes in Water Quality Impacts

Alternative 1B would not result in an increase in water quality standard violations under the climate change scenarios evaluated. Alternative 1B would not result in significant adverse changes in Delta water quality causing the violation of a water quality standard under the 2030 or 2070 climate change conditions. **Table 5-7** shows the changes in water quality standards compliance.

TABLE 5-7
INCREMENTAL PHASE 2 EXPANSION COMPARED TO THE 160 TAF NO PROJECT/NO ACTION ALTERNATIVE
CHANGES IN THE FREQUENCY OF POTENTIAL WATER QUALITY STANDARDS VIOLATIONS

	Rock Slough [days]	Sacramento River at Emmaton [days]	San Joaquin River at Jersey Pt [days]	San Joaquin at Brandt Bridge [days]	Old River near Middle River [days]	Old River at Tracy [days]
Future, with Climate Change 2030[1]	**15.0**	**11.5**	**18.3**	**5.2**	**5.3**	**6.0**
Change under Alt 1B[1]	-0.2	-0.1	-0.6	0.0	0.0	0.0
Future, with Climate Change 2070	**9.8**	**17.3**	**12.7**	**6.3**	**6.9**	**7.0**
Change under Alt 1B	0.4	-0.2	-0.5	0.0	0.0	0.0

NOTE:
1 Results from Table 4.2-21 & are repeated here for comparison to the Future, with Climate Change 2070 condition.

5.4.3 Potential Changes to Delta Hydrologic and Hydrodynamic Conditions

Alternative 1 B would result in negligible changes to Delta inflow under both climate change scenarios. Changes in Delta outflow would be small, reduced by less than three tenth of one percent (<0.3%). As noted in Sections 4.2 and 4.3, all of the action alternatives the increase diversions and subsequently decrease Delta outflow typically occur when the Delta is in surplus and would not impact other water users. Alternative 1B would not change the X2 position under the 2030 and 2070 climate change scenarios. Alternative 1B would increase the Export/Inflow ratio less than half of one percent (<0.4%). Alternative 1 B would increase Old and Middle River flows slightly, less than six tenths of one percent (<0.6%), under the 2070 climate change scenarios. Alternative 1B would not adversely affect hydrologic and hydrodynamic conditions in the Delta under the 2030 or 2070 climate change conditions. **Table 5-8** shows changes in hydrologic and hydrodynamic conditions.

TABLE 5-8
INCREMENTAL PHASE 2 EXPANSION COMPARED TO THE 160 TAF NO PROJECT/NO ACTION ALTERNATIVE
SUMMARY OF CHANGES USED TO EVALUATE HYDRODYNAMIC CONDITIONS

	Delta Inflow[1] [cfs]	Delta Outflow [cfs]	X2 Position [km]	Export / Inflow Ratio	OMR[2] [cfs]
Future, with Climate Change 2030[3]	**31563**	**23370**	**74**	**0.31**	**-2214**
Percent Change under Alt 1B	0.0%	-0.3%	0.0%	0.4%	0.0%
Future, with Climate Change 2070 Condition	**32469**	**24909**	**76**	**0.27**	**-1806**
Percent Change under Alt 1B	-0.1%	-0.3%	0.0%	0.4%	0.6%

NOTES:
1 Includes flows from Sacramento River and San Joaquin River
2 Dec-Jun for all years
3 Results from Table 4.3-6 & are repeated here for comparison to the Future, with Climate Change 2070 condition

5.4.4 Resilience of Benefits

Alternative 1B provides ecosystem improvement benefits while providing water supply reliability benefits for Local Agency Partners. The benefits of the Phase 2 Expansion Alternative 1B would be resilient under the climate change scenarios projected. Drought emergency supply reliability would increase slightly from 36 TAF/year under the 2030 climate change scenario up to 42 TAF/year under the 2070 climate change scenario. The supplemental water supply benefits would decrease slightly from 31 TAF/year under the climate change scenario projected in 2030 to 29 TAF/year under climate change scenario projected in 2070. Ecosystem improvement benefits would decrease from 46 TAF/year under the climate change scenario projected in 2030 to 42 TAF/year under the climate change scenario projected in 2070. The delivered water quality improvements would continue but would be reduced in 2070. **Table 5-9** contains a summary of the Alternative 1B benefits under the future scenarios with and without climate change.

TABLE 5-9
SUMMARY OF ALTERNATIVE 1B BENEFITS COMPARED TO 160-TAF NO PROJECT/NO ACTION ALTERNATIVE

	Future Condition, With Climate Change 2030[1]	Future Condition, With Climate Change 2070
Water Supply Reliability: Non-Drought Emergency – Public Benefit	Additional storage, infrastructure interconnections among Local Agency Partners, and integrated operations could improve water supply reliability in the event of flood, earthquake, or levee failure in the Delta	
Water Supply Reliability: Drought Emergency Supply Reliability [TAF/year] – Public Benefit	36	42
Water Supply Reliability: Supplemental Water Supply [TAF/year]	31	29
Ecosystem Improvement Benefit [TAF/year] – Public Benefit	46	42
Delivered Water Quality Improvement [reduction in mg/L Cl^-]	Up to 29	Up to 24
State-wide Water System Integration	Integration with CVP/SWP Delta export operations, conjunctive use operations of Local Partner Agencies, facilitation of storing, transferring, delivery water from Local Agency Partner to another	
Recreation – Public Benefit	New marina, expanded interpretive center, upgraded interpretive facilities, new trail	

NOTES:

[1] Results repeated from Table 3.7

It is worth noting that the CWC climate change projection offers one possible climate future to consider. If the future climate is very different from the one provided by the CWC it is possible that the changes in impacts and benefits would also be very different from what is shown. There is considerable uncertainty regarding the future climate and accordingly uncertainty regarding how the Phase 2 Expansion would perform. However, as shown in this chapter, the changes to water supply and water quality due to the Phase 2 Expansion are small compared to the projected changes due to climate change and would likely remain small under a wide range of future climate scenarios.

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CHAPTER 6
Summary of Impacts

6.1 Overview of the Environmental Effects of the Alternatives

For the Phase 2 Expansion, four action alternatives and one No Project/No Action alternative were evaluated. Each of these alternatives is fully described in Chapter 2, Project Description. **Table 6-1** provides a summary of the major Phase 2 Expansion components, for use in comparing the environmental effects of the alternatives.

TABLE 6-1
MAJOR COMPONENTS OF PHASE 2 EXPANSION ALTERNATIVES

	160-TAF No Project / No Action Alternative	Alternative 1A	Alternative 1B	Alternative 2A	Alternative 4A
Operational Priority					
		Water Supply Reliability	Environmental Water Management & Water Supply Reliability	Environmental Water Management	Environmental Water Management & Water Supply Reliability
Proposed Modifications to Existing Facilities					
Los Vaqueros Reservoir Capacity	160 TAF	275 TAF	275 TAF	275 TAF	160 TAF
Los Vaqueros Reservoir Maximum Water Surface Elevation	507 feet	560 feet	560 feet	560 feet	507 feet
Pumping Plant #1 Capacity	200 cfs	350 cfs	350 cfs	350 cfs	350 cfs
Transfer Pump Station Capacity	150 cfs	200 cfs	200 cfs	200 cfs	200 cfs
EBMUD Walnut Creek Pumping Plant Variable Frequency Drives	None	Included	Included	Included	Included
Los Vaqueros Interpretive Center	No change	Improved	Improved	Improved	Improved
Los Vaqueros Watershed Office Barn	No change	Seismically upgraded and improved	Seismically upgraded and improved	Seismically upgraded and improved	Seismically upgraded and improved

TABLE 6-1 (CONTINUED)
MAJOR COMPONENTS OF PHASE 2 EXPANSION ALTERNATIVES

	160-TAF No Project / No Action Alternative	Alternative 1A	Alternative 1B	Alternative 2A	Alternative 4A
Proposed New Facilities					
Transfer-Bethany Pipeline Capacity	None	300 cfs	300 cfs	300 cfs	300 cfs
Delta-Transfer Pipeline Capacity	None	180 cfs	180 cfs	180 cfs	None
Expanded Transfer Facility Pump Station Capacity	None	300 cfs	300 cfs	300 cfs	300 cfs
Expanded Transfer Facility Storage Reservoir Capacity	None	5 MG	5 MG	5 MG	5 MG
Neroly High-Lift Pump Station Capacity	None	350 cfs	350 cfs	350 cfs	350 cfs
EBMUD-CCWD Intertie Pump Station	None	155 cfs	155 cfs	155 cfs	155 cfs
Los Vaqueros Marina Complex	No change	Relocated upslope	Relocated upslope	Relocated upslope	No change
Los Vaqueros Watershed Trails	None	As described in Final EIS/EIR, and new trail at Mortero Wetland Complex	As described in Final EIS/EIR, and new trail at Mortero Wetland Complex	As described in Final EIS/EIR, and new trail at Mortero Wetland Complex	New trail at Mortero Wetland Complex
Brentwood Pipeline	None	Included	Included	Included	Included
ECCID Intertie	None	80 cfs	80 cfs	80 cfs	80 cfs

Table 6-2 provides a summary comparison of the chief environmental effects of the four Phase 2 Expansion alternatives and the No Project/No Action Alternative. In the table, Alternative 1A is compared to the No Project/No Action alternative, while Alternatives 1B, 2A, and 4A are compared with Alternative 1A.

TABLE 6-2
ALTERNATIVES IMPACT COMPARISON SUMMARY

Resource / Impact Issue	No Project / No Action	Alternative 1A (as compared to the No Action Alternative)	Alternative 1B (as compared to Alternative 1A)	Alternative 2A (as compared to Alternative 1A)	Alternative 4A (as compared to Alternative 1A)
Section 4.2: Delta Hydrology and Water Quality					
Water supply delivery	No new facilities would be constructed, no existing facilities would be modified. No change in operations of the Los Vaqueros Reservoir system or the Central Valley Project (CVP) or State Water Project (SWP) in a way that would have a direct or indirect effect on water supply. Water supply reliability for CCWD and other Bay Area water agencies would not be improved and additional emergency storage for CCWD and other Bay Area water agencies would not be increased. No additional supplies for improved environmental water management would be provided, and no additional water would be diverted through positive-barrier fish screens.	No significant adverse changes in Delta inflow, Delta outflow, upstream flows, CVP or SWP deliveries, or CVP and SWP reservoir carry-over storage that would cause impacts to the water supply of other users under existing and future conditions. Small changes in total Delta diversions, largely in periods with surplus flows, resulting in a more reliable water supply for the South Bay agencies, and no changes in SWP and CVP water supply deliveries. It would not affect water supplies of other water users. Average Delta outflow changes would be less than significant in both magnitude and timing, decreasing by less than half of 1 percent difference from the No Project/No Action Alternative under Existing, Future without Climate Change and Future with Climate Change 2030 conditions.	Same as Alternative 1A.	Same as Alternative 1A.	Same as Alternative 1A.
Delta water quality	No new facilities would be constructed, no existing facilities would be modified. No change in operations of the Los Vaqueros Reservoir system or the CVP or SWP in a way that would have a direct or indirect effect on water quality	Alternative 1A operations would not result in adverse changes in water quality causing the violation of a water quality standard or result in changes to Delta water quality that would result in significant adverse effects on beneficial uses.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Delta water levels	No new facilities would be constructed, no existing facilities would be modified. No change in operations of the Los Vaqueros Reservoir system or the CVP or SWP in a way that would have a direct or indirect effect on water levels for other Delta water users.	Largest decrease in Delta water levels estimated at lower-low tide during irrigation season would be -0.11 foot, which is less than 1.5 inches, and would occur infrequently (occurred once during irrigation season in modeled 82-year study period).	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A

TABLE 6-2 (CONTINUED)
ALTERNATIVES IMPACT COMPARISON SUMMARY

Resource / Impact Issue	No Project / No Action	Alternative 1A (as compared to the No Action Alternative)	Alternative 1B (as compared to Alternative 1A)	Alternative 2A (as compared to Alternative 1A)	Alternative 4A (as compared to Alternative 1A)
Section 4.2: Delta Hydrology and Water Quality (cont.)					
Mokelumne River flow and groundwater recharge/flooding	No new facilities would be constructed, no existing facilities would be modified. No change in operations of the Los Vaqueros Reservoir system or the CVP or SWP in a way that would have a direct or indirect effect on Mokelumne River flow, and associated groundwater recharge or flooding.	Alternative 1A operations would not result in changes in Mokelumne River flow that would significantly affect groundwater recharge or significantly increase the potential for flooding.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Cumulative effects on deliveries of water to other users, changes in Delta water quality, or change in Delta water levels, changes in groundwater recharge due to changes in Mokelumne River flows, and changes flooding due to changes in Mokelumne River flows.	No new facilities would be constructed, no existing facilities would be modified. No change in operations of the Los Vaqueros Reservoir system or the CVP or SWP in a way that would have cumulatively considerable effects on water supply, Delta water quality or Delta water levels in the context of combined past, present, and probable future projects.	Alternative 1A combined with a number of future projects could result in significant adverse effects on Delta water quality and delivery of water to others; however Alternative 1A operations would not result in a cumulatively considerable contribution to significant adverse cumulative effects on deliveries of water to other users, changes in Delta water quality, or change in Delta water levels. Alternative 1A would not result in substantial changes in Mokelumne River flows and associated groundwater recharge or flooding effect; or result in a cumulatively considerable contribution in any adverse cumulative effect.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Section 4.3: Delta Fisheries and Aquatic Resources					
In-channel construction - effects on fish/aquatic resources.	No new facilities would be constructed in-channel, no existing facilities would be modified. No impact.	Construction of a new Delta Intake on Old River not included. No Impact.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Underwater sound-pressure - effects on fish/aquatic resources	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction of a new Delta Intake on Old River not included. No Impact.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A

TABLE 6-2 (CONTINUED)
ALTERNATIVES IMPACT COMPARISON SUMMARY

Resource / Impact Issue	No Project / No Action	Alternative 1A (as compared to the No Action Alternative)	Alternative 1B (as compared to Alternative 1A)	Alternative 2A (as compared to Alternative 1A)	Alternative 4A (as compared to Alternative 1A)
Section 4.3: Delta Fisheries and Aquatic Resources (cont.)					
Dewatering of cofferdam - effects on fish	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction of a new Delta Intake on Old River not included. No Impact.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Loss of aquatic habitat	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction of a new Delta Intake on Old River not included. No Impact.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Hydraulic conditions - changes due to new Delta intake structure and effects on fish	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction of a new Delta Intake on Old River not included. No Impact.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Delta hydrodynamic conditions that affect Delta fish populations and aquatic habitat	No new facilities would be constructed, no existing facilities would be modified. No impact.	Water diversion operations would not result in significant adverse changes in Delta hydrodynamic conditions that affect Delta fish populations or quality and quantity of aquatic habitat within the Sacramento-San Joaquin River system, including the Delta. Less than significant.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Increased entrainment	No new facilities would be constructed, no existing facilities would be modified. No impact.	Alternative 1A would not have a significant effect on the direct entrainment or impingement of fish. Less than significant	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Fish screen maintenance activities - increase fish entrainment at the new Delta Intake or Old River Intake	No new facilities would be constructed, no existing facilities would be modified. No impact.	No new facilities would be constructed, no existing facilities would be modified. No impact.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Operation of the project alternatives could result in changes to Delta hydrodynamic conditions that affect the growth of algal blooms	There would be no changes to operations that would affect Delta hydrodynamics and algal blooms. No impact.	Alternative 1A would not significantly impact Delta hydrodynamics or other factors that may affect the growth of harmful algal blooms in the Delta. Less than significant.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A

TABLE 6-2 (CONTINUED)
ALTERNATIVES IMPACT COMPARISON SUMMARY

Resource / Impact Issue	No Project / No Action	Alternative 1A (as compared to the No Action Alternative)	Alternative 1B (as compared to Alternative 1A)	Alternative 2A (as compared to Alternative 1A)	Alternative 4A (as compared to Alternative 1A)
Section 4.3: Delta Fisheries and Aquatic Resources (cont.)					
Operation of the project could result in fish habitat, outmigration, flows that support fish species habitat, or water temperature or quality for species in the lower Mokelumne River, Pardee Reservoir, and/or Camanche Reservoir	No new facilities would be constructed, no existing facilities would be modified. No impact on fish species and habitat/water conditions in the lower Mokelumne River, Pardee Reservoir, and/or Camanche Reservoir.	Alternative 1A would not result in operation of the project such that substantial changes in fish in fish habitat, outmigration, flows that support fish species habitat, or water temperature or quality for species in the lower Mokelumne River, Pardee Reservoir, and/or Camanche Reservoir would occur	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Cumulative effects on Delta fisheries and aquatic resources	No new facilities would be constructed, no existing facilities would be modified. No contribution to cumulative impacts.	Alternative 1A when combined with other planned projects and climate change or projects under construction in the area, could adversely affect Delta fisheries and aquatic resources; however the changes caused by Alternative 1A would remain small and they would not be cumulatively considerable in the context of combined past, present, and probable future projects. Less than significant. Could cumulatively contribute to substantial adverse impacts to Delta fisheries and aquatic resources.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Section 4.4: Geology, Soils and Seismicity					
Seismic hazards - ground shaking, liquefaction, and local slope stability	No new facilities would be constructed, no existing facilities would be modified. No impact.	All proposed facilities would be designed and engineered in accordance with seismic code requirements and/or in accordance with mitigation; therefore, would not expose people or structures to increased risk of loss, injury, or death involving strong seismic ground shaking or seismic-related ground failure, including liquefaction and landslides.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A

TABLE 6-2 (CONTINUED)
ALTERNATIVES IMPACT COMPARISON SUMMARY

Resource / Impact Issue	No Project / No Action	Alternative 1A (as compared to the No Action Alternative)	Alternative 1B (as compared to Alternative 1A)	Alternative 2A (as compared to Alternative 1A)	Alternative 4A (as compared to Alternative 1A)
Section 4.4: Geology, Soils and Seismicity (cont.)					
Soil erosion and loss of topsoil	No new facilities would be constructed, no existing facilities would be modified. No impact.	During construction, could result in substantial soil erosion or the loss of topsoil.	Same as Alternative 1A	Same as Alternative 1A	Generally same as Alternative 1A; potentially less loss of topsoil due to wind erosion under this alternative.
Unstable soils including expansive soils	No new facilities would be constructed, no existing facilities would be modified. No impact.	A site-specific geotechnical investigation would be conducted and a report prepared for all major facilities. Recommendations and appropriate mitigation would be implemented to minimize or eliminate soil stability constraints and risks.	Same as Alternative 1A	Same as Alternative 1A	Fewer facilities would result in less impact than Alternative 1A,otherwise same as Alternative 1A
Cumulative effects related to geology, soils or seismicity	No new facilities would be constructed, no existing facilities would be modified. No contribution to cumulative impacts.	Construction would not make a cumulatively considerable contribution to cumulative effects associated with erosion, topsoil loss or increased exposure to seismic or other geohazard risks.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Section 4.5: Local Hydrology, Drainage and Water Quality					
Water quality	No new facilities would be constructed, no existing facilities would be modified. No impact.	Potential for increased erosion and sedimentation to local waterways, release of fuels or other hazardous materials during construction, or dewatering of excavated areas that could result in substantial water quality degradation.	Same as Alternative 1A	Same as Alternative 1A	Similar types of impact but much less extent of impact than Alternative 1A due to construction of fewer facilities.
Local groundwater supplies and groundwater recharge	No new facilities would be constructed, no existing facilities would be modified. No impact.	Dewatering of construction area would result in localized and temporary changes in groundwater levels near the active dewatering sites but would not deplete local groundwater supplies. Facility sites would interfere with groundwater recharge to an insignificant extent.	Same as Alternative 1A	Same as Alternative 1A	Similar types of impact but much less extent of impact than Alternative 1A due to construction of fewer facilities.

TABLE 6-2 (CONTINUED)
ALTERNATIVES IMPACT COMPARISON SUMMARY

Resource / Impact Issue	No Project / No Action	Alternative 1A (as compared to the No Action Alternative)	Alternative 1B (as compared to Alternative 1A)	Alternative 2A (as compared to Alternative 1A)	Alternative 4A (as compared to Alternative 1A)
Section 4.5: Local Hydrology, Drainage and Water Quality (cont.)					
Drainage patterns	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction would not substantially alter drainage patterns but reservoir expansion would increase the reservoir shoreline area subject to erosion.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Runoff water	No new facilities would be constructed, no existing facilities would be modified. No impact.	With implementation of mitigation, construction would not create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems but would increase potential stormwater pollution run off. Would not provide substantial additional sources of polluted runoff during operation.	Same as Alternative 1A	Same as Alternative 1A	Similar type of impact but less extent of impact than Alternative 1A due to construction of fewer facilities.
Flood hazard	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction could place structures within a 100-year flood hazard area as mapped on a federal Flood Insurance Rate Map but facilities would not appreciably impede or redirect flood flows.	Same as Alternative 1A	Same as Alternative 1A	Alternative 4A would not place structures within a 100-year flood hazard area.
Risk of inundation from dam or levee failure	No new facilities would be constructed, no existing facilities would be modified. No impact.	Reservoir expansion and construction would not increase the risk inundation by dam or levee failure.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Cumulative effects related to drainage, flooding, groundwater recharge or water quality degradation in the project area	No new facilities would be constructed, no existing facilities would be modified. No contribution to cumulative impacts.	Construction and operation of Alternative 1A would not make a cumulatively considerable contribution to cumulative effects on drainage, flooding, groundwater recharge or water quality degradation in the project area.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A

TABLE 6-2 (CONTINUED)
ALTERNATIVES IMPACT COMPARISON SUMMARY

Resource / Impact Issue	No Project / No Action	Alternative 1A (as compared to the No Action Alternative)	Alternative 1B (as compared to Alternative 1A)	Alternative 2A (as compared to Alternative 1A)	Alternative 4A (as compared to Alternative 1A)
Section 4.6: Biological Resources					
NCCP habitat types / CDFW sensitive plant communities	No new facilities would be constructed; no existing facilities would be modified. No impact.	Construction would affect the following NCCP habitat types (CDFW sensitive plant communities in parentheses): Natural Seasonal Wetland (i.e., bulrush-cattail series, northern claypan vernal pool, bush seepweed, and saltgrass series), Valley/Foothill Riparian (i.e., valley oak series), Grassland (i.e., purple needlegrass series) and Valley/Foothill Woodland Forest (i.e., blue oak series).	Same as Alternative 1A	Same as Alternative 1A	Would result in permanent losses to the same sensitive plant communities as Alternative 1A but to a reduced extent.
Jurisdictional wetlands, waters of the U.S. or the State, and streambeds and banks	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction could permanently affect up to 9 acres jurisdictional wetlands, waters of the U.S. or the State, or streambeds and banks and temporarily affect 0.5 to 1.0 acres. Total impact is 9.5 to 10 acres.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A except 2 acres affected permanently and less than 1 acre affected temporarily. Total impact is less than 3 acres.
Special-status plant species	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction could affect populations of special-status plant species including brittlescale, San Joaquin spearscale, Brewer's dwarf-flax.	Same as Alternative 1A	Same as Alternative 1A	Reduced impacts compared to Alternative 1A, Alternative 4A would avoid impacts to Brewer's Dwarf-flax.
California red-legged frog and California tiger salamander habitat	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction would result in impacts on California red-legged frog and California tiger salamander, including aquatic breeding habitat (11 ponds permanently and 5 temporarily) as identified in the Final EIS/EIR, newly constructed mitigation ponds (0.5 to 1 acre), and upland aestivation habitat (1,126 acres permanently and 233 acres temporarily) for these species.	Same as Alternative 1A	Same as Alternative 1A	Reduced impacts compared to other Alternatives because it would not include further dam modifications or inundation. Impact from potential loss of aquatic and upland habitats could result from pipeline and other facility construction.

TABLE 6-2 (CONTINUED)
ALTERNATIVES IMPACT COMPARISON SUMMARY

Resource / Impact Issue	No Project / No Action	Alternative 1A (as compared to the No Action Alternative)	Alternative 1B (as compared to Alternative 1A)	Alternative 2A (as compared to Alternative 1A)	Alternative 4A (as compared to Alternative 1A)
Section 4.6: Biological Resources (cont.)					
Western pond turtle populations	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction would result in direct and indirect impacts on existing populations of and habitat for western pond turtle.	Same as Alternative 1A	Same as Alternative 1A.	Same as Alternative 1A, though to a lesser extent because of smaller reservoir and fewer facilities.
Vernal pool species and habitat	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction would result in direct and indirect impacts on 16 ponds containing listed vernal pool branchiopods and their habitat, and on the non-listed midvalley fairy shrimp and curved-foot hygrotus diving beetle. Additionally newly constructed mitigation ponds (0.5 to 1 acre) would be impacted.	Same as Alternative 1A	Same as Alternative 1A	Compared to Alternative 1A, there would be fewer impacts on vernal pool species or habitat because Alternative 4A would not include construction of the Delta-Transfer Pipeline.
San Joaquin kit fox habitat and regional movement	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction would have temporary and permanent impacts on potential San Joaquin kit fox habitat (approximately 1,467 acres) and permanently reduce potential regional movement opportunities on western side of reservoir.	Same as Alternative 1A	Same as Alternative 1A	Direct kit fox habitat impacts under Alternative 4A would be less than under Alternative 1A (150 acres) due to the exclusion of Delta-Transfer pipeline construction further dam modification. Alternative 4A would not result in further regional movement impacts.
Burrowing owl habitat	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction would result in temporary and permanent loss of habitat for burrowing owl, affecting 477 acres temporarily and 498.5 acres permanently.	Same as Alternative 1A	Same as Alternative 1A	Less than under Alternative 1A due to the exclusion of the Delta-Transfer Pipeline and further dam modification.
Golden eagle, bald eagle, and Swainson's hawk species and habitat	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction and operation activities would result in direct and indirect impacts on existing populations of and habitat for golden eagle, bald eagle, and Swainson's hawk.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A, though to a lesser extent.
			B (bald eagle)	B (bald eagle)	NI (bald eagle)

TABLE 6-2 (CONTINUED)
ALTERNATIVES IMPACT COMPARISON SUMMARY

Resource / Impact Issue	No Project / No Action	Alternative 1A (as compared to the No Action Alternative)	Alternative 1B (as compared to Alternative 1A)	Alternative 2A (as compared to Alternative 1A)	Alternative 4A (as compared to Alternative 1A)
Section 4.6: Biological Resources (cont.)					
Alameda whipsnake habitat	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction and increased reservoir water levels would result in temporary and permanent loss of potential and occupied habitat for Alameda whipsnake. 6.9 acres permanently impacted and 0.5 acres temporarily impacted and the incremental impact of nonscrub habitat would be approximately 80 acres.	Same as Alternative 1A	Same as Alternative 1A	Alternative 4A would have reduced potential for construction related direct impacts, but could still result in a significant impact.
Valley elderberry longhorn beetle species and habitat	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction activities could result in direct and indirect impacts on valley elderberry longhorn beetle and its habitat, affecting elderberry shrubs.	Same as Alternative 1A	Same as Alternative 1A	Same temporary impacts as Alternative 1A. No elderberry shrubs would be lost.
Breeding bird nest sites and migratory birds	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction activities could affect active breeding bird nest sites.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Critical habitat for listed species (vernal pool fairy shrimp and Contra Costa goldfields)	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction activities could affect designated critical habitat for listed species (vernal pool fairy shrimp and Contra Costa goldfields). 145.4 acres of vernal pool fairy shrimp habitat could be affected, and 98.1 acres of Contra Costa goldfields habitat, as identified in the Final EIS/EIR.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Special-status reptile species (San Joaquin coachwhip and coast horned lizard)	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction activities could affect nonlisted special-status reptile species (San Joaquin coachwhip and coast horned lizard). 943.6 acres to be affected permanently and 252.6 acres affected temporarily.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A though to a lesser extent, given that no expansion of the reservoir is proposed under Alternative 4A.

TABLE 6-2 (CONTINUED)
ALTERNATIVES IMPACT COMPARISON SUMMARY

Resource / Impact Issue	No Project / No Action	Alternative 1A (as compared to the No Action Alternative)	Alternative 1B (as compared to Alternative 1A)	Alternative 2A (as compared to Alternative 1A)	Alternative 4A (as compared to Alternative 1A)
Section 4.6: Biological Resources (cont.)					
Special-status mammal species (American badger, special-status bats, and San Joaquin pocket mouse)	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction activities could affect nonlisted special-status mammal species (American badger, special-status bats, and San Joaquin pocket mouse). 943.6 acres to be affected permanently and 252.6 acres affected temporarily.	Same as Alternative 1A	Same as Alternative 1A.	Same as Alternative 1A though to a lesser extent, given that no expansion of the reservoir is proposed under Alternative 4A.
Pacific Flyway species (waterfowl and shorebirds)	No new facilities would be constructed, no existing facilities would be modified. No impact.	Draining the reservoir during project construction could affect Pacific Flyway species, including waterfowl and shorebirds.	Same as Alternative 1A	Same as Alternative 1A	Unlike Alternative 1A, the reservoir would not be fully drained during construction; Alternative 4A impacts to Pacific Flyway species would be reduced compared to Alternative 1A impacts.
Local and regional conservation plans and ordinances protecting biological resources	No new facilities would be constructed, no existing facilities would be modified. No impact.	With implementation of mitigation, would not result in inconsistency with local and regional conservation plans, or local plans or ordinances protecting biological resources.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Cumulative effects on special-status species and habitats	No new facilities would be constructed, no existing facilities would be modified. No contribution to cumulative impacts.	With implementation of mitigation, construction would not make a cumulatively considerable contribution to cumulative effects on special-status species and habitats.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Section 4.7: Land Use					
Divide existing communities of Byron or Discovery Bay	No new facilities would be constructed, no existing facilities would be modified. No impact.	Facilities would not divide established communities.	Same as Alternative 1A	Same as Alternative 1A	. Same as Alternative 1A
Conflict with any applicable land use plans	No new facilities would be constructed, no existing facilities would be modified. No impact.	Facilities would be located within the CCWD Watershed, on or adjacent to existing water system facility sites or in rural/agricultural areas. Facility siting in these locations would not conflict with applicable land use plans.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A

TABLE 6-2 (CONTINUED)
ALTERNATIVES IMPACT COMPARISON SUMMARY

Resource / Impact Issue	No Project / No Action	Alternative 1A (as compared to the No Action Alternative)	Alternative 1B (as compared to Alternative 1A)	Alternative 2A (as compared to Alternative 1A)	Alternative 4A (as compared to Alternative 1A)
Section 4.7: Land Use (cont.)					
Conflict with aviation safety policies	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction activities within designated Airport Land Use Compatibility Zones near the Byron Airport could conflict with aviation safety policies such as height restrictions or nighttime lighting.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Create flight hazards at local airport	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction activities within the Airport Influence Area for Byron Airport could cause potential temporary flight hazards through: the creation of glare or distracting lights; the generation of dust or smoke, which could impair pilot visibility; or could attract an increased number of birds.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Cumulative effects related to conflicts with land use plans and policies or dividing an existing community	No new facilities would be constructed, no existing facilities would be modified. No contribution to cumulative impacts.	No conflicts with any applicable land use plan or policy adopted for the purpose of reducing or avoiding environmental impacts.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Section 4.8: Agriculture					
Temporarily affect Important Farmland	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction could temporarily affect about 109.5 acres of Important Farmlands.	Same as Alternative 1A	Same as Alternative 1A	Compared to Alternative 1A, Alternative 4A would have less of an impact on Important Farmlands. Temporary construction-related impacts would be less than significant with mitigation.
Permanently convert Important Farmland	No new facilities would be constructed, no existing facilities would be modified. No impact.	Mitigation would avoid permanent conversion resulting from temporary ground-disturbance and pipeline siting impacts. Permanent conversion of up to 0.5 acre of Prime Farmland at EBMUD-CCWD Intertie Pump Station site.	Same as Alternative 1A	Same as Alternative 1A	Alternative 4A does not include the Delta-Transfer Pipeline, but as with Alternative 1A, significant effects on important farmland could occur from ECCID Intertie Pipeline and EBMUD-CCWD Intertie Pump Station.

TABLE 6-2 (CONTINUED)
ALTERNATIVES IMPACT COMPARISON SUMMARY

Resource / Impact Issue	No Project / No Action	Alternative 1A (as compared to the No Action Alternative)	Alternative 1B (as compared to Alternative 1A)	Alternative 2A (as compared to Alternative 1A)	Alternative 4A (as compared to Alternative 1A)
Section 4.8: Agriculture (cont.)					
The project would not conflict with zoning for agricultural use or a Williamson Act contract.	No new facilities would be constructed, and no changes in CCWD facilities or operations would conflict with zoning for agricultural use or a Williamson Act contract.	Under Alternative 1A, up to nine properties with Williamson Act contracts would be temporarily affected by construction of pipelines because these facilities would require acquisition of temporary construction easements, and in the case of the Transfer-Bethany Pipeline, a temporary construction plus a permanent utility easement.	Same as Alternative 1A	Same as Alternative 1A.	Compared to Alternative 1A, there would be fewer land under Williamson Act contracts affected by the project under Alternative 4A, because the Delta-Transfer Pipeline would not be included under this alternative.
Cumulative temporary effects upon agricultural land and long-term conversion of Important Farmlands to non-agricultural uses	No new facilities would be constructed, no existing facilities would be modified. No contribution to cumulative impacts.	After mitigation, the incremental contribution of farmland conversion associated with Alternative 1A would not be a cumulatively considerable contribution to an existing significant cumulative impact.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Section 4.9: Transportation and Circulation					
Traffic congestion during construction	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction activities would intermittently and temporarily increase traffic congestion due to vehicle trips generated by construction workers and construction vehicles on area roadways.	Same as Alternative 1A	Same as Alternative 1A	Reduced compared to Alternative 1A.
Access and emergency services disruption and creation of traffic safety hazards during construction	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction activities would intermittently and temporarily impede access to local streets or adjacent uses, including access for emergency vehicles and could substantially increase traffic hazards due to construction in or adjacent to roads or possible road wear.	Same as Alternative 1A	Similar to Alternative 1A	Same as Alternative 1A.

TABLE 6-2 (CONTINUED)
ALTERNATIVES IMPACT COMPARISON SUMMARY

Resource / Impact Issue	No Project / No Action	Alternative 1A (as compared to the No Action Alternative)	Alternative 1B (as compared to Alternative 1A)	Alternative 2A (as compared to Alternative 1A)	Alternative 4A (as compared to Alternative 1A)
Section 4.9: Transportation and Circulation (cont.)					
Traffic safety hazards during construction	No new facilities would be constructed; no existing facilities would be modified. No impact.	Construction activities would intermittently and temporarily increase potential traffic safety hazards for vehicles, bicyclists, and pedestrians on public roadways due to increased traffic volumes.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Cumulative transportation and circulation effects	No new facilities would be constructed, no existing facilities would be modified. No contribution to cumulative impacts.	Construction, when combined with construction of other future projects, could contribute to construction-related short-term cumulative impacts to traffic and transportation (traffic congestion, access disruption, and traffic safety).	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Section 4.10: Air Quality					
Criteria air pollutant emissions / Federal general conformity	No facilities would be constructed and no impacts associated with criteria air pollutants would result.	Construction would generate short-term emissions of criteria air pollutants: ROG, NOx, CO, and PM10, that could potentially contribute to existing nonattainment conditions and further degrade air quality. However, this alternative would not exceed federal general conformity *de minimis* standards for emissions.	Same as Alternative 1A	Same as Alternative 1A	Emissions would be less that those under Alternative 1A, given no expansion of the reservoir under Alternative 4A.
Violation of applicable air quality standards	No facilities would be constructed and no violation of applicable air quality standards would result.	Operation would not result in emissions of criteria air pollutants at levels that would substantially contribute to a potential violation of applicable air quality standards or to nonattainment conditions.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Expose sensitive receptors to substantial pollutant concentrations	No facilities would be constructed and no impacts associated with substantial pollutant concentrations would result.	With implementation of mitigation, construction and/or operation would not expose sensitive receptors to substantial pollutant concentrations.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A

TABLE 6-2 (CONTINUED)
ALTERNATIVES IMPACT COMPARISON SUMMARY

Resource / Impact Issue	No Project / No Action	Alternative 1A (as compared to the No Action Alternative)	Alternative 1B (as compared to Alternative 1A)	Alternative 2A (as compared to Alternative 1A)	Alternative 4A (as compared to Alternative 1A)
Section 4.10: Air Quality (cont.)					
Objectionable odors	No facilities would be constructed and no impacts associated with objectionable odors would result.	Operation would not create objectionable odors affecting a substantial number of people.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Cumulative greenhouse gas emissions	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction and operation would not make a cumulatively considerable contribution to greenhouse gas emissions. CCWD would continue to implement actions to reduce GHG emissions of its overall water system enterprise.	Same as Alternative 1A	Same as Alternative 1A	Reduced construction and operational emissions compared to Alternative 1A
Cumulative air quality effects	No new facilities would be constructed, no existing facilities would be modified. No contribution to cumulative impacts.	Construction could result in cumulatively considerable increases of criteria pollutant emissions, though impacts from fugitive dust emissions would be lessened by mitigation. Operation would not make a cumulatively considerable contribution to regional air quality impacts.	Same as Alternative 1A	Same as Alternative 1A	Reduced emissions compared to Alternative 1A
Section 4.11: Noise					
Exceed local noise standards during construction	No new facilities would be constructed, no existing facilities would be modified. No impact.	Facilities construction would generate noise levels that exceed noise thresholds at nearby sensitive receptors if construction activities are carried out during noise-sensitive hours.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Exceed local noise standards during operation	No new facilities would be constructed, no existing facilities would be modified. No impact.	Project operations would generate traffic, stationary source, and area source noise similar to existing noise associated with operation of Los Vaqueros Reservoir system and would not exceed County noise requirements.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A

TABLE 6-2 (CONTINUED)
ALTERNATIVES IMPACT COMPARISON SUMMARY

Resource / Impact Issue	No Project / No Action	Alternative 1A (as compared to the No Action Alternative)	Alternative 1B (as compared to Alternative 1A)	Alternative 2A (as compared to Alternative 1A)	Alternative 4A (as compared to Alternative 1A)
Section 4.11: Noise (cont.)					
Ground-borne vibration or noise.	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction would not expose persons to or generate excessive ground-borne vibration or ground-borne noise levels.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Cumulative effects of construction and operation noise and vibration	No new facilities would be constructed, no existing facilities would be modified. No contribution to cumulative noise or vibration impacts.	No cumulatively considerable contribution to operational noise levels or ground-borne vibration. Potential for cumulative noise impacts if construction overlaps with other projects in the vicinity (i.e., City of Antioch's East Lone Tree Focus Area and/or various road safety improvements).	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Section 4.12: Utilities and Public Service Systems					
Disrupt utility services / public health hazard	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction could temporarily disrupt utility services during construction such that a public health hazard could be created or an extended service disruption could result.	Same as Alternative 1A	Same as Alternative 1A	Reduced compared to Alternative 1A
Require or result in new or expanded utility infrastructure or public service facilities that result in substantial adverse physical impacts	No new facilities would be required, no existing facilities would be modified. No impact.	Alternative 1A would not require or result in construction of new or expanded utility infrastructure or public service facilities that would result in substantial adverse physical impacts.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Solid waste generation / exceed the capacity of local landfills.	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction activities would generate solid waste for disposal but this would not exceed the capacity of local landfills.	Same as Alternative 1A	Same as Alternative 1A	Reduced compared to Alternative 1A
Cumulative effects upon public services and utilities, or local landfill capacity	No new facilities would be constructed, no existing facilities would be modified. No contribution to cumulative utility or public service impacts.	Construction could result in cumulatively considerable contributions to cumulative effects on public services and utilities, and local landfill capacity.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A

TABLE 6-2 (CONTINUED)
ALTERNATIVES IMPACT COMPARISON SUMMARY

Resource / Impact Issue	No Project / No Action	Alternative 1A (as compared to the No Action Alternative)	Alternative 1B (as compared to Alternative 1A)	Alternative 2A (as compared to Alternative 1A)	Alternative 4A (as compared to Alternative 1A)
Section 4.12: Utilities and Public Service Systems (cont.)					
Result in wasteful, inefficient, or unnecessary consumption of energy / require construction of addition energy infrastructure facilities	No new facilities would be constructed, no existing facilities would be modified. No impact.	None of the proposed energy-consuming construction activities associated with each facility would be a wasteful, inefficient, or unnecessary use of energy. Alternative 1A would not require or result in construction of new or expanded energy infrastructure facilities.	Same as Alternative 1A	Same as Alternative 1A	Reduced energy consumption compared to Alternative 1A
Section 4.13: Hazardous Materials / Public Health					
Health risks during construction	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction would not create significant health risks due to exposure to subsurface soils and groundwater during construction.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Accidental release of hazardous materials during construction or operation	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction or operation could, through routine transport, use or disposal, accidentally release hazardous materials thereby exposing construction workers, project personnel and the public to hazardous materials or accidentally releasing hazardous materials into the soil, groundwater, and/or a nearby surface water body.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Wildland fires	No new facilities would be constructed, no existing facilities would be modified. No impact.	Improper handling or use of flammable or combustible materials such as internal combustion equipment could result in wildland fires, exposing people or structures to a significant risk of loss, injury, or death.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Electrical transmission facilities within 150 feet of a school	No new facilities would be constructed; no effects on public health or safety related to electrical transmission facilities.	No construction of electrical transmission facilities.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A

TABLE 6-2 (CONTINUED)
ALTERNATIVES IMPACT COMPARISON SUMMARY

Resource / Impact Issue	No Project / No Action	Alternative 1A (as compared to the No Action Alternative)	Alternative 1B (as compared to Alternative 1A)	Alternative 2A (as compared to Alternative 1A)	Alternative 4A (as compared to Alternative 1A)
Section 4.13: Hazardous Materials / Public Health (cont.)					
Cumulative effects associated with hazardous materials or other hazards	No new facilities would be constructed, no existing facilities would be modified. No contribution to cumulative impacts.	Construction or operation would not cause cumulatively considerable contributions to any significant cumulative effect related to hazardous materials or public health, accidental hazardous material spills, or wildland fires.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Emit hazardous emissions / involve handing of hazardous material within 0.25 mile of school	No new facilities would be constructed; no effects on public health or safety related to hazardous emissions.	Alternative 1A would involve construction of pipeline with 0.25 miles of a school. Construction of the pipeline has the potential to release hazardous materials and emit hazardous emissions.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Section 4.14: Visual/Aesthetic Resources					
Negative aesthetic effect on a scenic vista.	No new facilities would be constructed, no existing facilities would be modified. No impact.	Would not have a substantial, demonstrable negative aesthetic effect on a scenic vista.	Same as Alternative 1A	Same as Alternative 1A	Alternative 4A impacts would be reduced compared to Alternative 1A because fewer components would be constructed.
Degrade the existing visual character or quality	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction activities and facility siting of Alternative 1A components would not substantially degrade the existing visual character or quality of the site and its surroundings.	Same as Alternative 1A	Same as Alternative 1A	Alternative 4A impacts would be reduced compared to Alternative 1A because fewer components would be constructed.
New source of light or glare	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction and operations would not result in creation of a new source of substantial light or glare that would be visible to the public or recreational users.	Same as Alternative 1A	Same as Alternative 1A	Alternative 4A impacts would be reduced compared to Alternative 1A because fewer components would be constructed.
Cumulative effects upon scenic vistas, visual character or quality, or new sources of light or glare	No new facilities would be constructed, no existing facilities would be modified. No contribution to cumulative impacts.	No cumulatively considerable contribution to adverse effects on visual/aesthetic resources in the project area or broader region.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A

TABLE 6-2 (CONTINUED)
ALTERNATIVES IMPACT COMPARISON SUMMARY

Resource / Impact Issue	No Project / No Action	Alternative 1A (as compared to the No Action Alternative)	Alternative 1B (as compared to Alternative 1A)	Alternative 2A (as compared to Alternative 1A)	Alternative 4A (as compared to Alternative 1A)
Section 4.15: Recreation					
Loss of recreation areas	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction would require closure of Los Vaqueros Watershed to the public during the construction period and additional restrictions for water-related activities during drawdown and filling, causing short-term loss of recreation areas and activities provided in the watershed (fishing boating, hiking, picnicking, interpretive center). Following construction, Watershed would reopen to the public with similar but expanded recreational facilities and use areas. There would be no long-term adverse effects on recreation; there would be long-term benefits.	Same as Alternative 1A	Same as Alternative 1A	Alternative 4A would not require closure of the watershed or reservoir to recreational use. Other improvements under Alternative 4A would be similar to Alternative 1A, in that they would have short term effects and long-term benefits.
Increased use of existing parks or recreational facilities	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction would not increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated.	Same as Alternative 1A	Same as Alternative 1A	Alternative 4A construction would be of shorter duration, and similar to Alternative 1A would not increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated.
Cumulative effects on recreation facilities, opportunities or experiences	No new facilities would be constructed, no existing facilities would be modified. No contribution to cumulative impacts.	No cumulatively considerable contribution that would reduce recreational opportunities, increase the use of existing neighborhood and regional parks, or otherwise contribute to a cumulative effect on recreation facilities, opportunities or experiences.	Same as Alternative 1A	Same as Alternative 1A	Alternative 4A impacts would be reduced compared to Alternative 1A because fewer components would be constructed.

TABLE 6-2 (CONTINUED)
ALTERNATIVES IMPACT COMPARISON SUMMARY

Resource / Impact Issue	No Project / No Action	Alternative 1A (as compared to the No Action Alternative)	Alternative 1B (as compared to Alternative 1A)	Alternative 2A (as compared to Alternative 1A)	Alternative 4A (as compared to Alternative 1A)
Section 4.16: Cultural and Paleontological Resources					
Disturbance of historical or archaeological resources	No new facilities would be constructed, no existing facilities would be modified. No impact.	Potential to impact 38 known historical resources, the reburial site, and the Kellogg Creek Historic District due to construction and/or operation. There are additional areas of moderate to high potential for undiscovered cultural resources as well as human remains within the APE.	Same as Alternative 1A	Same as Alternative 1A	Alternative 4A would result in less impact than Alternative 1A, affecting 9 historic properties (29 fewer than Alternative 1A), as well as the reburial site and Kellogg Creek District. Potential effects to previously unidentified cultural resources would be reduced compared to Alternative 1A because fewer facilities would be constructed.
Paleontological resources	No new facilities would be constructed, no existing facilities would be modified. No impact.	Earth disturbing activities would disturb ground below the surface soil horizon and underlying bedrock, and could intersect and destroy fossil resources within certain sedimentary formations.	Same as Alternative 1A	Same as Alternative 1A	Alternative 4A impacts would be reduced compared to Alternative 1A because fewer components would be constructed.
Disturbance of human remains	No new facilities would be constructed, no existing facilities would be modified. No impact.	Impact to six known burial sites as well as the reburial site. Ground disturbing activities in some areas with moderate to high potential for previously unrecorded human remains.	Same as Alternative 1A	Same as Alternative 1A	Alternative 4A would not affect the reburial site and would have fewer impacts to known human remains when compared to Alternative 1A. While the extent of impacts would be less, the nature of the impacts on known and previously unrecorded human remains would be equivalent to those from Alternative 1A.

TABLE 6-2 (CONTINUED)
ALTERNATIVES IMPACT COMPARISON SUMMARY

Resource / Impact Issue	No Project / No Action	Alternative 1A (as compared to the No Action Alternative)	Alternative 1B (as compared to Alternative 1A)	Alternative 2A (as compared to Alternative 1A)	Alternative 4A (as compared to Alternative 1A)
Section 4.16: Cultural and Paleontological Resources (cont.)					
Cumulative effects associated with disturbance of historical, archaeological or paleontological resources or disturbance of human remains	No new facilities would be constructed, no existing facilities would be modified. No contribution to cumulative impacts.	Construction would contribute to cumulative impacts on cultural and paleontological resources. Construction would not result in cumulative impacts associated with disturbance of human remains.	Same as Alternative 1A	Same as Alternative 1A	Cumulative impacts to paleontological resources would be less but similar to Alternative 1A. Cumulative effects to cultural resources would be similar to but less than Alternative 1A.
Section 4.17: Socioeconomic Effects					
Local income and employment	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction could temporarily generate new income and local employment affecting Contra Costa County's economy and resulting in beneficial impacts to the local economy.	Same as Alternative 1A	Same as Alternative 1A	Similar compared to Alternative 1A though economic benefits would be significantly less under Alternative 4A.
Agricultural effects upon local economy	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction and operational effects on Contra Costa County's agricultural economy would be very minor.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Recreation income effects upon local economy	No new facilities would be constructed, no existing facilities would be modified. No impact.	Short-term loss of recreation income associated with construction effects upon Contra Costa County's economy would be very minor.	Same as Alternative 1A	Same as Alternative 1A	Alternative 4A would not require closure of the watershed or reservoir to recreational use.
Cumulative effects upon local income and employment	No new facilities would be constructed, no existing facilities would be modified. No contribution to cumulative impacts.	Construction, when combined with construction of other future projects, could beneficially affect income and local employment.	Same as Alternative 1A	Same as Alternative 1A	Less beneficial impact compared to Alternative 1A
Cumulative effects upon local agricultural economy	No new facilities would be constructed, no existing facilities would be modified. No contribution to cumulative impacts.	The incremental contribution of farmland conversion would not be cumulatively considerable.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A.
Cumulative effects of recreation income upon local economy	No new facilities would be constructed, no existing facilities would be modified. No contribution to cumulative impacts.	Cumulative economic impacts from project-related construction and relocation of the recreation facilities would be minor.	Same as Alternative 1A	Same as Alternative 1A	No impact.

TABLE 6-2 (CONTINUED)
ALTERNATIVES IMPACT COMPARISON SUMMARY

Resource / Impact Issue	No Project / No Action	Alternative 1A (as compared to the No Action Alternative)	Alternative 1B (as compared to Alternative 1A)	Alternative 2A (as compared to Alternative 1A)	Alternative 4A (as compared to Alternative 1A)
Section 4.18: Environmental Justice					
Disproportionately affect identified minority and/or low income communities	No new facilities would be constructed, no existing facilities would be modified. No impact.	Construction impacts to areas with minority or low-income populations would not cause a disproportionate impact to the minority and low-income community in the area, because mitigation would reduce construction related traffic and air quality impacts to less than significant levels.	Same as Alternative 1A	Same as Alternative 1A	Pumping Plant #1 replacement would occur under Alternative 4A; impacts associated with air quality would be reduced to less than significant with mitigation.
Disproportionately affect local employment opportunities for identified minority and/or low income communities	No new facilities would be constructed, no existing facilities would be modified. No impact.	Employment opportunities including apprentice positions could result in minor beneficial effects that would be equally available to all populations.	Same as Alternative 1A	Same as Alternative 1A	Alternative 4A would involve less construction, reducing opportunities for local employment; however, these jobs would be equally available to communities of concern.
Cumulative effects upon identified minority and/or low income communities	No new facilities would be constructed, no existing facilities would be modified. No contribution to cumulative impacts.	Construction effects would not disproportionately affect nearby minority and/or low-income communities.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Cumulative effects upon local employment opportunities for identified minority and/or low income communities	No new facilities would be constructed, no existing facilities would be modified. No contribution to cumulative impacts.	Construction and operation would not disproportionately affect local employment opportunities for minority and/or low-income communities in the vicinity of the project.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A
Section 4.19: Indian Trust Assets					
Indian Trust Asset land affected	No Trust land affected.	No Trust land affected.	Same as Alternative 1A	Same as Alternative 1A	Same as Alternative 1A

TABLE 6-2 (CONTINUED)
ALTERNATIVES IMPACT COMPARISON SUMMARY

Resource / Impact Issue	No Project / No Action	Alternative 1A (as compared to the No Action Alternative)	Alternative 1B (as compared to Alternative 1A)	Alternative 2A (as compared to Alternative 1A)	Alternative 4A (as compared to Alternative 1A)
Section 4.20: Growth-Inducing Effects					
Growth Inducement	CCWD would continue operating the existing Los Vaqueros Reservoir and other CCWD facilities to deliver water to meet its customer demands and delivered water quality goal subject to current regulatory and physical constraints. The Local Agency Partners and Refuges operations would likewise be unchanged, and their water supply reliability would not be improved through use of the existing Los Vaqueros Reservoir system, except through separate partnership agreements that could be developed in the future but are not contemplated in this analysis.	This alternative would improve water supply reliability of the Local Partner Agencies and CCWD. This alternative would not support growth beyond that already planned for these agencies, except for SFPUC wholesale customers. In many years, Alternative 1A could provide most or all of the additional 1 TAF/year of supplemental supply to SFPUC that may be available for unplanned growth. However, because this incremental 1 TAF/year would be unavailable during one third of all years, it is unlikely that planning agencies would identify this as a reliable source of supply that would remove an obstacle to additional, unplanned growth.	Alternative 1B would provide less supplemental supply than Alternative 1A, and therefore for the same reasons would not be likely to remove an obstacle to unplanned growth.	Alternative 2A is unlikely to serve even the existing demand for SFPUC supply in San José and Santa Clara because it would only deliver the necessary 9 TAF/year 20 percent of the time. Therefore, this alternative would not support making San José and Santa Clara permanent SFPUC customers based on existing demand, would not provide water for planned growth, and would provide no water for unplanned growth.	Alternative 4A would provide less supplemental supply than Alternative 1A, and therefore for the same reasons would not be likely to remove an obstacle to unplanned growth.

CHAPTER 7
Environmental Review and Agency Consultation/Coordination

Since the initial phases of Los Vaqueros Reservoir Expansion Project development beginning in 2001, CCWD and Reclamation have engaged and consulted with agencies, stakeholders, landowners, and the general public. This chapter provides updates to the summary of public and agency involvement activities in Chapter 7 of the Final EIS/EIR, Volume 2.

7.1 Stakeholder Consultation

The extensive public and stakeholder involvement process described in the Final EIS/EIR has continued. The Agency Coordination Work Group formed in 2003 no longer meets; instead there have been many rounds of one-on-one coordination meetings between the Local Agency Partners and CCWD, multi-agency meetings among CCWD and Local Agency Partners, and meetings among CCWD, Reclamation, Refuge managers, non-governmental organizations, and other Refuge stakeholders. Public meetings to present the Phase 2 Expansion project and receive input will be held after the Draft Supplement to the Final EIS/EIR is released to the public.

In addition, presentations and discussions of the Phase 2 Expansion occur regularly in venues such as East Bay Leadership Council Water Task Force meetings, Bay Area Regional Reliability Drought Task Force meetings, Association of California Water Agency meetings and conferences, and Water Education Foundation activities.

7.2 Public Scoping

Public scoping for the EIS/EIR in compliance with NEPA and CEQA was completed in 2008. No additional public scoping was required for this Supplement.

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CHAPTER 8
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CHAPTER 9
List of Supplement Preparers

This Supplement to the Final EIS/EIR was prepared by CCWD and Reclamation. A list of persons who prepared various sections of the Supplement, significant background materials, or participated to a significant degree in preparing the Supplement is presented below and in **Table 9-1**.

Bureau of Reclamation (NEPA Lead Agency)

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TABLE 9-1
LIST OF PREPARERS

Name	Qualifications	Participation
ESA		
Leslie Moulton	B.A., Human Biology; 28 years experience	Principal-in-Charge
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TABLE 9-1 (CONTINUED)
LIST OF PREPARERS

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CHAPTER 10
Glossary

100-year flood	The flood having a one percent chance of being equaled or exceeded in magnitude in any given year. Contrary to popular belief, it is not a flood occurring once every 100 years.
acre-foot (AF)	The volume of water that would cover 1 acre to a depth of 1 foot. Equal to 1,233.5 cubic meters (43,560 cubic feet).
Action Specific Implementation Plan (ASIP)	Document that may serve as a biological assessment for compliance with Section 7 of the Federal Endangered Species Act and the natural community conservation plan for compliance with the California Endangered Species Act and the California Natural Community Conservation Planning Act.
Alternative Intake Project (AIP)	The CCWD intake completed in 2010 that is located along Victoria Canal and connected to the Old River Pipeline. The maximum capacity of the intake is 250 cubic feet per second. The intake was renamed the Middle River Intake in 2010.
anadromous fish	Fish that spend a part of their lifecycle in the sea and return to freshwater streams to spawn.
appropriation	The right to withdraw water from its source.
artificial neural network (ANN)	A nonlinear statistical data tool with which complex relationships between inputs and outputs are modeled.
Bay Area	San Francisco Bay Area
Bay-Delta	San Francisco Bay/Sacramento-San Joaquin estuary.
beneficial uses	Those uses of water as defined in the State of California Water Code (Chapter 10, Part 2, Division 2), including but not limited to, agricultural, domestic, municipal, industrial, power generation, fish and wildlife, recreation, and mining.
bentonite	A clay mineral used in drilling operations; mixed with water to form a gel that lubricates the drill bit, helps keep the walls of a borehole intact, and helps bring drill cuttings to the surface.

Biological Opinion	Document issued under the authority of the Federal Endangered Species Act stating the findings of the U.S. Fish and Wildlife Service and/or National Marine Fisheries Service as to whether a federal action is likely to jeopardize the continued existence of a threatened or endangered species or result in the destruction of adverse modification of critical habitat.
borrow area	An excavated area or pit created by the removal of earth material to be used as fill in a different location.
bromate	A chemical compound of bromine that can be formed from the ozonation of water containing bromide. A disinfection byproduct of ozone water treatment.
bromide	A chemical compound of bromine with another element or radical naturally occurring in small concentrations in sea water. Bromides interact with disinfection agents used in water treatment to create disinfection byproducts that have potential adverse health effects.
CALFED Bay-Delta Program (CALFED)	Joint federal and state program to address water-related issues in the Sacramento-San Joaquin Delta.
California Environmental Quality Act (CEQA)	Act requiring California public agency decision-makers to document and consider the environmental impacts of their actions. Also requires an agency to identify ways to avoid or reduce environmental damage and to implement those measures where feasible. Provides means to encourage public participation in the decision-making process.
California WaterFix	Project proposed by the California Department of Water Resources that includes new diversion facilities in the north Delta on the Sacramento River at Hood and new tunnel conveyance and ancillary facilities to improve water supply reliability for south-of-Delta water users. This project was previously known as the Bay Delta Conservation Plan.
CalSim II	Agreed upon CVP-SWP implementation of the CalSim model code.
CalSim model	A planning model designed to simulate the operations of the CVP and SWP reservoir and water delivery system under current and future conditions; predicts how reservoir storage and river flows would be affected based on changes in system operations; output is typically used to help assess impacts on water supply, water quality, aquatic resources, and recreation.

Central Valley Project (CVP)	Multiple-purpose federal water project operated by the Bureau of Reclamation in California extending from the Cascades to the Tehachapi Mountains. Consists of 20 dams and reservoirs, 11 power plants, and 500 miles of major canals, as well as conduits, tunnels, and related facilities. Manages some 9 million acre-feet of water.
channel	Natural or artificial watercourse, with a defined bed and banks to confine and conduct continuously or periodically flowing water.
CNEL	Community Noise Equivalent Level adds a 5-dBA "penalty" for the evening between 7:00 p.m. and 10:00 p.m. in addition to a 10-dBA penalty between 10:00 p.m. and 7:00 a.m. See also "decibel (dB)", below.
conjunctive use	A water management strategy for the coordinated use of groundwater and surface water resources.
consumptive uses	The application of water to agricultural, municipal, or industrial uses. In contrast, non-consumptive uses would include water dedicated to fish and wildlife.
Contra Costa Canal	The 48-mile canal that begins at Rock Slough and travels west to Clyde, south to Walnut Creek, and north to Martinez.
cooperating agency	Any federal agency other than the lead agency that has jurisdiction by law or special expertise with respect to the environmental impacts expected to result from a proposed project.
criteria air pollutants	Pollutants that are the primary focus of regulatory agencies as indicators of ambient air quality, which include ozone, carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (PM), and lead. These are the most prevalent air pollutants known to be harmful to human health, and extensive documentation on health-effects criteria is available for them.
critical habitat	An area designated as critical habitat listed in 50 CFR Parts 17 or 226 (50 CFR Section 402.02); specific geographic areas, whether occupied by special-status species or not, that are determined to be essential for the conservation and management of the special-status species, and that have been formally described in the Federal Register.
cryptosporidium	A waterborne intestinal parasite of the genus Cryptosporidium that can cause the disease cryptosporidiosis in humans and other vertebrates. The disease, characterized by vomiting, diarrhea, abdominal cramps, and fever, can be severe or fatal to immuno-suppressed individuals.

cubic foot per second (cfs)	A measurement of water flow equivalent to one cubic foot of water passing a given point in a second.
cultural resource	An aspect of a cultural system that is valued by or significantly representative of a culture or that contains significant information about a culture. Properties such as landscapes or districts, sites, buildings, structures, objects, or cultural practices that are usually more than 50 years old and possess architectural, historic, scientific, or other technical value.
cumulative impact	For NEPA purposes, defined in Council of Environmental Quality (CEQ) regulations as the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions. Under CEQA, defined as the change in the environment that results from the incremental impact of the project when added to other, closely related past, present, and reasonably foreseeable probable future projects.
CVP Improvement Act (CVPIA)	This federal legislation, signed into law on October 30, 1992, mandates major changes in the management of the Federal CVP; puts fish and wildlife on an equal footing with agricultural, municipal, industrial, and hydropower uses.
CVP Operations Criteria and Plan (OCAP)	Document that identifies the factors influencing the physical and institutional conditions and decision-making process under which the CVP operates.
CVP Tracy Pumping Plant	The CVP pumping plant in the south Delta.
CVP water	As defined by Section 3403(f) of the CVPIA, all water developed, diverted, stored, or delivered in accordance with statutes authorizing the CVP, in accordance with terms and conditions of water rights acquired pursuant to California law; water diverted by CCWD under its CVP contract.
Day Evening Sound Level/Community Noise Equivalent Level (Ldn/CNEL)	The average sound level over a 24-hour period, with a penalty of 5 dB added for the evening hours or 5 p.m. to 10 p.m., and a penalty of 10 dB added for the nighttime hours of 10 p.m. to 7 a.m.
decibel (dB)	A unitless measure of sound on a logarithmic scale that indicates the squared ratio of sound pressure amplitude to a reference sound pressure amplitude. The reference pressure is 20 micro-pascals. An A-weighted dB (dBA) is an overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear. A measurement that includes the low frequency component is denoted by dBL.

delivered water	General term for water provided to CCWD untreated- and treated-water customers.
Delta	In this report, "Delta" refers to the delta formed by the Sacramento and San Joaquin Rivers. See also "Sacramento-San Joaquin Delta," below.
Delta balanced conditions	During balanced conditions, Delta inflow and exports are controlled by Reclamation and DWR to meet SWRCB environmental and water quality standards, the needs of in-Delta diverters, and CVP/SWP exports from the Delta. Balanced conditions in the Delta can occur at any time of the year, but generally occur during late spring, summer, and fall, or during very dry years.
Delta excess conditions	During excess (also known as surplus) conditions, Delta flow requirements for water quality and environmental regulations have been met, and excess water is available for Delta users.
Delta inflow	The combined water flow entering the Delta at a given time from the Sacramento River, San Joaquin River, and other Central Valley tributaries.
Delta outflow	The net amount of water (not including tidal flows) at a given time flowing out of the Delta towards the San Francisco Bay. The Delta outflow equals Delta inflow minus the water used within the Delta and exported from the Delta.
Delta smelt	A small, slender-bodied fish with a typical adult size of 2 to 3 inches that is found only in the Sacramento-San Joaquin Delta estuary.
Delta surplus	Under excess conditions in the Delta, surplus water is available to Delta users after all environmental protection and water quality regulations have been met.
desalination	A process whereby the salt concentration of sea water or brackish water is reduced, generally through an advanced form of water treatment.
dewater	To remove water.
disinfection byproducts (DBPs)	Chemical, organic, and/or inorganic substances that can form during a reaction of a disinfectant (such as chlorine or ozone) with naturally occurring materials in water.
diversion	A location where water is removed from a water body (river, creek, reservoir, etc.) for use in another location.

DNL	The 24-hour day and night A-weighted noise exposure level, which accounts for the greater sensitivity of most people to nighttime noise by weighting noise levels at night ("penalizing" nighttime noises). Noise between 10:00 p.m. and 7:00 a.m. is weighted (penalized) by adding 10 dBA to take into account the greater annoyance of nighttime noises.
DSM2	The Delta hydrodynamic and salinity model developed by DWR to simulate hydrodynamic and mixing processes in the Delta, using upstream river flows and salinities, downstream tidal stage and salinity, diversion rates, agricultural return flow and seepage rates, and salinities as boundary conditions.
ecosystem	A geographically identifiable area that encompasses unique physical and biological characteristics. An ecosystem is the sum of the plant community, animal community, and environment in a particular region or habitat.
electric and magnetic fields (EMF)	Fields of force caused by electric voltage and current around the electric wire or conductor when an electric transmission line or any electrical wiring is in operation. Magnetic fields exist only when current is flowing. Electric fields are present in electrical appliances and cords whenever they are plugged in.
electrical conductivity (EC)	A measure of salinity in water.
endangered species	Any species or subspecies of bird, mammal, fish, amphibian, reptile, or plant that is in serious danger of becoming extinct throughout all or a significant portion of its range. Official federal designations of endangered species are made by the USFWS or NMFS and published in the Federal Register. Species are listed under the California Endangered Species Act by the California Department of Fish and Game.
Endangered Species Act (ESA)	The federal or state acts administered by the USFWS/NMFS and California Department of Fish and Game, respectively, to list and protect animal and plant species that are listed as threatened or endangered, are formally recognized candidates for listing, or are declining to a point where they may be listed.
entrainment	The incidental trapping of fish and other aquatic organisms in water diverted from streams, rivers, and reservoirs. The process of drawing fish into diversions along with water, resulting in the loss of such fish.
Environmental Impact Report (EIR)	A detailed statement (i.e., report) prepared under the California Environmental Quality Act by a state or local agency describing and analyzing the significant environmental effects of a project and discussing ways to mitigate or avoid the effects.

Environmental Impact Statement (EIS)	An environmental impact document required of federal agencies under the National Environmental Policy Act for major projects or legislative proposals significantly affecting the environment. Describes the positive and negative effects of the proposed action, lists alternative actions, and documents the information required to evaluate the environmental impacts of a proposed action.
environmental justice	Defined by the U.S. Environmental Protection Agency (EPA) Office of Environmental Justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." Fair treatment means "no group of people, including racial, ethnic, or socioeconomic group shall bear a disproportionate share of negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies."
erosion	The gradual wearing away of land by water, wind, and general weather conditions; the diminishing of property by the elements. With regard to levees specifically: loss of levee material as a result of the effects of channel flows, tidal action, boat wakes, and wind-generated waves.
evapotranspiration	Water losses from the surface of soils and plants.
expansive soils	Soils that shrink and swell as a result of moisture changes.
export	Water diversion from the Delta used for purposes outside the Delta.
export/inflow (E/I) ratio	This requirement of the SWRCB Water Rights Order D-1641 presently limits Delta exports by the state and federal water projects to a percentage of Delta inflow. In July through January, 65% of inflow can be exported. During February through June, months most critical to fisheries, the allowable E/I ratio is reduced to 35% to help diminish reverse flows and the resulting entrainment of fish caused by south Delta export operations.
federal P&Gs	Principles and Guidelines for federal water studies, published as "Federal Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies" by the U.S. Water Resources Council, 1983.
fish screen	Barrier on the front face of a river intake to prevent fish and debris from being drawn into the intake.

floodplain	Any land area susceptible to inundation by floodwaters from any source.
flow	The volume of water passing a given point per unit of time.
groundwater	Any water naturally stored underground in aquifers, or that flows though and saturates soil and rock, supplying springs and wells.
habitat	The specific area or environment in which a particular type of animal or plant lives.
historic property	Any prehistoric or historic district, site, building, structure, or object included in or eligible for inclusion in the National Register of Historic Places (NRHP). The term eligible for inclusion in the NRHP pertains to both properties that the Secretary of the Interior has formally determined to be eligible and to all properties that meet NRHP listing criteria.
impingement	Contact or collision with a diversion structure (used to describe deleterious effects of some diversion facilities on aquatic species).
Important Farmland	Farmland categories mapped by the California Department of Conservation Farmland Mapping and Monitoring Program (FMMP). Prime Farmland, Farmland of Statewide Importance, Unique Farmland, and Farmland of Local Importance are often described together under the term "Important Farmland."
Indian Trust Assets (ITAs)	Legal interests in property held in trust by the United States for federally-recognized Indian tribes or individual Indians. An Indian trust has three components: (1) the trustee, (2) the beneficiary, and (3) the trust asset.
integrated water resource planning	An open and participatory planning process emphasizing least-cost principles and a balanced consideration of objectives, infrastructure risk, supply, resources and demand management options for meeting water needs.
L50	The noise level that is equaled or exceeded 50 percent of the specified time period. The L50 represents the median sound level.
L90	The noise level that is equaled or exceeded 90 percent of the specified time period. The L90 is sometimes used to represent the background sound level.

Leq	The equivalent sound level is used to describe noise over a specified period of time, typically one hour, in terms of a single numerical value. The Leq is the constant sound level that would contain the same acoustic energy as the varying sound level, during the same time period (i.e., the average noise exposure level for the given time period).
levee	An embankment raised to restrict a river to a defined channel.
liquefaction	The process in which soil loses cohesion when subject to seismic activity (i.e., shaking).
Lmax	The instantaneous maximum noise level for a specified period of time.
Level 2 refuge water	Level 2 refuge water, as specified in Section 3406(d)(1) of the Central Valley Project Improvement Act (CVPIA), is water delivered to each CVPIA refuge through long-term Central Valley Project water contracts.
Incremental Level 4 refuge water	Incremental Level 4 refuge water, as specified in Section 3406(d)(2) of the Central Valley Project Improvement Act (CVPIA), is water acquired from willing sellers and delivered to the CVPIA refuges.
Los Vaqueros Project	CCWD's 1998 project which included the construction of the Los Vaqueros Reservoir and associated facilities, such as the Old River intake and Old River, transfer, and Los Vaqueros pipelines. The primary purposes of the Los Vaqueros Project are to improve the quality of water supplied to CCWD customers, to minimize seasonal water quality changes in delivered water, and to improve the reliability of the emergency water supply available to CCWD.
Middle River Intake	The CCWD intake completed in 2010 that is located along Victoria Canal and connected to the Old River Pipeline. The maximum capacity of the intake is 250 cubic feet per second. The intake was previously named the Alternative Intake Project.
minimum flow	Lowest flow in a specified period of time.
mitigation	One or more of the following: (1) avoiding an impact altogether by not taking a certain action or parts of an action; (2) minimizing an impact by limiting the degree or magnitude of an action and its implementation; (3) rectifying an impact by repairing, rehabilitating, or restoring the affected environment; (4) reducing or eliminating an impact over time by preservation and maintenance operations during the life of an action; and/or (5) compensating for an impact by replacing or providing substitute resources or environments.

modeling	Computer simulations of natural and man-made water systems used to provide a forecast of outcomes for a variety of parameters, such as water quality, flow rates, and reservoir levels, under an assumed set of conditions.
National Environmental Policy Act (NEPA)	Act that directs federal agencies to prepare an environmental impact statement for all major federal actions that may have a significant effect on the environment. States that it is the goal of the federal government to use all practicable means, consistent with other considerations of national policy, to protect and enhance the quality of the environment. Requires all federal agencies to consider the environmental impacts of their proposed actions during the planning and decision-making processes.
Notice of Availability (NOA)	The notice issued by a local, state, or federal agency to publicly announce that a draft environmental impact report or environmental impact statement is available for review, pursuant to the California Environmental Quality Act and the National Environmental Policy Act, respectively.
Notice of Intent (NOI)	The notice issued by a federal agency to publicly announce its intention to prepare an environmental impact statement, pursuant to the National Environmental Policy Act.
Notice of Preparation (NOP)	The notice issued by a state or local agency to publicly announce its intention to prepare an environmental impact report, pursuant to the California Environmental Quality Act.
Old and Middle River flow restrictions	Requirements in the 2008 U.S. Fish and Wildlife Service and 2009 National Marine Fisheries Service Operations Criteria and Plan Biological Opinions that the Central Valley Project and State Water Project be operated to maintain specified values of combined net northward flow in Old and Middle Rivers for the protection of listed fish species.
Old River intake	The CCWD intake located on Old River, with conveyance facilities linked to the Contra Costa Canal and Los Vaqueros Reservoir. The maximum capacity of the intake is 250 cubic feet per second.
opacity	The amount of light obscured by particle pollution in the atmosphere.
peak flow	Maximum instantaneous flow in a specified period of time.

Piezometer	A device used to measure ground-water pressure head at a point in the subsurface. It can consist of either a vertical open pipe that allows the depth to the water in pipe to be measured, or an electronic instrument (or less commonly pneumatic or hydraulic) embedded in the ground that records hydrostatic pressure.
Probable maximum flood	The largest flood that could conceivably occur at a particular location.
Qwest	A broad indication of the net direction and quantity of flow in the San Joaquin River at Jersey Point. This is only an indicator since net flow is not measurable at this location. Considerable tidal exchange at this point is not included, because Qwest is an estimate of net flow conditions. A positive Qwest indicates the net flow is generally in the downstream direction towards San Francisco Bay. A negative number indicates that the net flow is generally in the upstream direction to the east. Generally, a positive Qwest is desirable for Delta flow circulation, water quality, and fisheries.
reclamation district	A district formed under California State Water Code 50000 *et. seq.* as a way to pay for the costs of reclaiming land for future use. Reclamation districts are formed in areas that have been inundated with water, such as swamps, salt marshes, or tidelands.
Record of Decision (ROD)	Concise, public, legal document that identifies and officially discloses the federal lead agency's decision following the completion of an environmental impact statement.
recycled water	Wastewater that becomes suitable for a specific beneficial use as a result of treatment.
reservoir	An artificially impounded body of water.
responsible agency	As per the CEQA Guidelines, a public agency other than the lead agency that has discretionary approval over a project.
riparian area	The land adjacent to a natural watercourse such as a river or stream. Riparian areas support vegetation that provides important wildlife habitat, as well as important fish habitat when sufficient to overhang the bank or fall into the water.
Rock Slough intake	The CCWD intake located near the town of Oakley and used to serve the Contra Costa Canal. Also referred to as Pumping Plant No. 1.
Sacramento splittail	A somewhat large (40-centimeter full-length) *Cyprinid* endemic to the Sacramento and San Joaquin River systems and other drainages of the San Francisco Bay.

Sacramento-San Joaquin Delta (Delta)	The legal Delta, as described in the California Water Code Section 12220, generally extends from Sacramento to the north, Tracy to the south, Interstate 5 to the east, and Collinsville to the west. The Delta covers approximately 738,000 acres.
salinity	The amount of dissolved salts in a given volume of water.
seawater intrusion	The intrusion and mixing of saline or brackish water into a body of freshwater (in this case, into the Delta).
sedimentation	The phenomenon of sediment or other fine particulates entering a water body, or being disturbed from the bottom of a water body such that they move downstream and settle on the substrate in other aquatic areas.
seiche	A wave on the surface of a lake or landlocked bay caused by atmospheric or seismic disturbances.
seismicity	The frequency, intensity, and distribution of earthquake activity in a given area.
siltation	Sediment influx either from erosion or sediment carried into a water body by inflowing rivers and tributaries.
soil corrosion	The deterioration of metal due to interaction with materials in the soil; corrosion generally occurs in soils with high moisture content, high electrical conductivity, high acidity, and high dissolved salts.
South Bay Aqueduct (SBA)	A State Water Project facility that conveys water from Bethany Reservoir to the South Bay water agencies in Alameda and Santa Clara Counties.
South Bay water agencies	The South Bay water agencies include the three water agencies served by the SBA (Alameda County Water District, Santa Clara Valley Water District, Alameda County Flood Control and Water Conservation District, Zone 7).
special-status species	Federal and state classifications for plant and animal species that are listed as threatened or endangered, are formally recognized candidates for listing, or are declining to a point where they may be listed.
stage	Water surface elevation; the elevation above mean sea level (msl) datum (typically measured in feet msl).

State Water Project (SWP)	California's largest water supply project operated and maintained by the California Department of Water Resources that stores surplus water during wet periods and later distributes it to areas of need in the San Francisco Bay area, northern California, San Joaquin Valley, and southern California. SWP facilities include 23 dams and reservoirs, 18 pumping plants, 4 generating-pumping plants, 5 hydroelectric power plants, and approximately 600 miles of canals and pipelines.
stormwater	Untreated surface runoff into a body of water during periods of precipitation.
Stormwater Pollution Prevention Plan (SWPPP)	Required to be developed and implemented when an entity is obtaining a General Permit under the National Pollutant Discharge Elimination System (NPDES). The SWPPP has two major objectives: (1) to help identify the sources of sediment and other pollutants that affect the quality of stormwater discharges, and (2) to describe and ensure the implementation of best management practices to reduce or eliminate sediment and other pollutants in stormwater as well as non-stormwater discharges.
subsidence	A decrease in ground surface elevation in the Delta, which results primarily from peat soil being converted into gas.
SWP Harvey O. Banks Pumping Plant	The SWP export pumping plant in the south Delta. The plant is located downstream of Clifton Court Forebay.
take	Defined in the Federal Endangered Species Act as "…harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct" on special-status species covered under the Act.
terrestrial species	Types of species of animals and plants that live on or grow from the land.
threatened species	Legal status afforded to plant or animals species that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range, as determined by the U.S. Fish and Wildlife Service or NMFS for federal species and by the California Department of Fish and Game for state species.
tidal flow	Water movements caused by tidal forces (i.e. gravitational); used to describe the movement of water in Delta channels caused by tidal level variations propagating from San Francisco Bay.
total Delta inflow	See Delta inflow.

total organic carbon (TOC)	A measure of organic matter content in water, which plays a significant role in aquatic ecosystems and has direct implications to drinking water treatment, including the potential for formation of disinfection byproducts.
traditional cultural properties (TCP)	Properties of traditional religious and cultural importance.
treated water	Water treated at a water treatment plant and delivered to municipal and industrial customers.
turbidity	A measure of the cloudiness of water caused by the presence of suspended matter. Turbidity in natural waters may be composed of organic and/or inorganic constituents, and has direct implications to drinking water treatment.
unregulated tributary	A tributary stream that does not have a reservoir or other feature used to restrain or control flows.
uplands	The area on the landward side of the tidal marsh, where the land surface is not inundated by even the highest tides.
useable water	Water that has a daily maximum electrical conductivity less than or equal to 1060 microSiemens per centimeter.
water right	A legal entitlement, granted as a permit or license from the California State Water Resources Control Board, authorizing water to be diverted from a specified source and put to beneficial, non-wasteful use.
water use efficiency	Refers to actions or activities that lead to sustainable or renewable uses of water and includes water conservation, water recycling and desalination.
waters of the U.S.	As defined in the Clean Water Act Section 404, waters of the U.S. applies only to surface waters, rivers, lakes, estuaries, coastal waters, and wetlands. Not all surface waters are legally waters of the U.S. Generally, those waters include interstate waters and tributaries, intrastate waters and tributaries used in interstate and/or foreign commerce, territorial seas at the cyclical high-tide mark, and wetlands adjacent to the above.
watershed	A region or area that ultimately drains to a particular watercourse or body of water.
wetland	A zone that is periodically or continuously submerged or has high soil moisture, has aquatic and/or riparian vegetation components, and is maintained by water supplies significantly in excess of those otherwise available through local precipitation.

wheeling	Transport of an agency's water supply through facilities owned by another agency.
Williamson Act	The California Land Conservation Act of 1965, commonly known as the Williamson Act, enables local governments to enter into contracts with private landowners for the purpose of restricting specific parcels of land to agricultural or related open space use for 10 years. In return, landowners receive property tax assessments that are based on farming and open space uses as opposed to full market value.
X2	An index used to assess the location of, and thus the movement of, salinity inland from the ocean to the Delta. Used by regulatory agencies to establish estuarine habitat objectives, it is defined as the distance in kilometers from the Golden Gate Bridge to the point at which 2 parts-per-thousand salinity is found at any given time.

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