6. CUMULATIVE IMPACTS

6.1 INTRODUCTION TO THE CUMULATIVE ANALYSIS

An analysis of cumulative impacts considers the combined effects of the proposed project, other past and present projects, and "reasonably foreseeable probable future projects" (State CEQA Guidelines §15355). In the case of the Water Forum Proposal, this involves attempting to foresee related projects occurring over the long-term future. The Water Forum Proposal would be implemented over the next three decades. During this same time period, it is expected that many other actions will be implemented that will affect the environmental conditions of the project's direct and indirect study areas.

ANALYSIS OF ONE FUTURE SCENARIO FOR CUMULATIVE CONDITIONS

A large degree of speculation and uncertainty exists when attempting to characterize the study area 30 years into the future, particularly recognizing the dynamic nature of decisions about water supply and resource protection in the Sacramento and San Joaquin River system. Therefore, it is difficult to define any one scenario as the reasonably foreseeable probable future. Nonetheless, to fulfill the requirements of State CEQA Guidelines §15355, to address future cumulative conditions, the programmatic analysis of this WFP uses one scenario as a good faith effort to assess future cumulative potential effects. The scenario was developed after a year of extensive discussions between the Water Forum technical consultants and the USBR and USFWS. Given all of the competing demands for water and water resource limitations, one outcome that is not speculative is the occurrence of significant impacts of some type in the future.

The future scenario for this EIR consists of past, present, and reasonably foreseeable probable future projects producing related or cumulative impacts. The cumulative condition, therefore, is defined for this EIR as the WFP and three other reasonably foreseeable probable future actions or sets of actions that could be quantified, including:

Increased Trinity River Flows. For modeling and analysis purposes, the WFP EIR assumes that Trinity River flows will be increased in accordance with the U.S. Bureau of Reclamation's (USBR) recent policy direction. Flows are proposed to be increased from existing levels to 390,000 acre-feet per year in drier years to 750,000 acre-feet per year in wetter years, thereby reducing exports to the Sacramento River.

East Bay Municipal Utility District (EBMUD) Supplemental Water Supply Project. EBMUD's proposed project, for this analysis includes diversion of up to 112,000 acre-feet per year of American River water subject to deficiencies imposed by the Central Valley Project.

Increased Water Demands. For modeling and analysis purposes, the WFP EIR assumes that increased water demands by State Water Project (SWP) contractors, Central Valley

Project (CVP) contractors, and other Sacramento Valley water users will occur. Increased demand volumes are based on projections by USBR and the California Department of Water Resources (DWR).

The WFP EIR does not serve as the environmental document for the above actions. The impacts of each of these actions would be evaluated in project-specific environmental documentation and, where appropriate, alternatives and mitigation measures recommended to reduce significant effects.

UNQUANTIFIABLE ASPECTS OF FUTURE CONDITIONS

In addition to uncertainty surrounding the volume of diversions in the future (i.e., 2030), many efforts are currently underway to address unfavorable conditions in the Sacramento River and Bay-Delta that cannot currently be quantified. Populations of fish species such as Delta smelt, steelhead and winter-run chinook salmon have declined over the past decades to the point that they have been listed as threatened or endangered, and other species such as fall-run and spring-run chinook salmon have been proposed for listing. At the same time, variable water availabilities, and environmental requirements have resulted in water delivery deficiencies imposed on SWP and CVP water contractors.

For these reasons the state and federal governments, in cooperation with local organizations, have begun implementing environmental restoration programs to reverse these biological declines. Since 1996, approximately $100 million has been expended on restoration projects, such as improving fish screens and restoring riverine habitat. Over the next 30 years over $1.5 billion will be spent on additional improvements.

Programs underway or planned to improve Sacramento River system and Bay-Delta fisheries and habitats include the Central Valley Project Improvement Act (CVPIA) Anadromous Fish Restoration Program (AFRP), and Ecosystem Restoration Program Plan (ERPP) of the CALFED Bay-Delta Program.

The effectiveness of these programs to improve Sacramento River and Bay-Delta conditions, however, is not guaranteed. In addition, there could be future environmental stressors that cannot be predicted. For instance, introduction of non-native species into aquatic habitats could have additional adverse impacts. It is not possible to speculate in the analysis how any of these considerations could affect cumulative impacts.

PROSPECTS FOR ADDITIONAL OR REALLOCATED WATER SUPPLY

Section 3406(b)(3) of the CVPIA directs the Department of the Interior to acquire additional water supplies. Specific options identified in that section include: improvements in or modifications to the operations of the project; water banking; conservation; transfers; conjunctive use; and temporary and permanent land fallowing, including purchase, lease, and option of water rights, and associated agricultural land. In addition, water bank operations can reallocate water in drier years to alleviate water delivery and environmental impacts. It is

speculative at this time to predict the success of projects to acquire additional or reallocate existing water resources. It is also recognized that in the future USBR and other agencies outside the Water Forum will make numerous operational decisions based on conditions existing at the time. Therefore, the cumulative impacts analyses in this EIR are based on one set of assumptions as to how USBR would operate CVP facilities if no additional water supply is developed, and no water is reallocated.

INSUFFICIENCY OF WATER SUPPLY FOR CUMULATIVE FUTURE NEEDS

The cumulative impact analysis indicates that unless new water is developed or water is reallocated, there will be insufficient water for USBR to meet some of its contractual and environmental obligations in the future.

The decrease in Shasta Reservoir storage, and reduction in flow below Keswick Dam is a surrogate for the volume of additional water that would have to be available in the future for environmental purposes to approximate Base Conditions. A decrease in Shasta Reservoir storage results in a reduced flow requirement below Keswick Dam, because flow requirements are based on Shasta Reservoir storage levels. Over the simulated 70-year hydrologic period Shasta Reservoir carryover storage was reduced by about 75,000 AF and flow below Keswick Dam was reduced by about 30,000 AF on an average annual basis. Combined, this represents an approximate average annual deficit of 105,000 AF, relative to the Base Condition. During the 1928 to 1934 critical period, Shasta Reservoir storage declines an average of about 75,000 AF per year, resulting in a total critical period storage deficit of about one half million acre feet. As a consequence of lower storage, the future cumulative simulation prescribes an average annual reduction in flow volume below Keswick Dam of about 15,000 AF, or about 100,000 AF over the critical period. Combined, the decrease in Shasta Reservoir storage and reduction in flow volume below Keswick Dam represent an annual average water deficit of about 90,000 AF and a total deficit approximating 600,000 AF for the future cumulative critical period relative to the Base Condition.

Due to the increased overall demands on the system, future cumulative condition hydrologic modeling indicates that lower deliveries to all categories of CVP contractors could occur in the future, and be most significant in the dry and driest years. Compared to the Base Condition, less water would be delivered to CVP contractors in about 30% of the years, and to SWP contractors in about 30% of the years.

CVP and SWP contract demands associated with future development will be higher than current demands. Even under the Base Condition full demands frequently are not met. One method to generally illustrate the water supply deficit to water contractors under the future cumulative condition is to estimate the amount of water associated with future delivery deficiencies if the same percentage of full demand was delivered in the future as was delivered under the Base Condition. This estimation indicates that over the 70-year hydrologic period simulated, combined CVP/SWP water delivery deficits could exceed 400,000 AF on an average annual basis. During the 1928 to 1934 critical period, combined CVP/SWP water delivery

deficits approach an average of nearly 400,000 AF per year, representing a total critical period deficit of nearly 2½ million AF.

USBR remains committed to taking all necessary actions that will allow water delivery and environmental obligations to be met. The Water Forum does not recommend or advocate not meeting any environmental or water delivery obligations.

Again, the analysis in this EIR is based on a reasonable set of assumptions as to how the system would be operated if no additional water supply is developed or no water is reallocated. The EIR discusses potential cumulative effects, given the uncertainties recognized above. A summary of cumulative impacts is provided in Table 2-3. In some instances, the WFP by itself would not result in a significant impact, but it would contribute to a significant cumulative impact. In these instances, the Draft EIR identifies the impact as significant even if the magnitude of the WFP's contribution is very small.

6.2 CUMULATIVE GROUNDWATER IMPACTS

This section provides a discussion of the cumulative impacts to groundwater resources that could occur in the future. It is assumed under this cumulative impacts analysis that the WFP would be in place. Because groundwater pumping within Sacramento County does not change between the two comparative future conditions, the impacts identified with the implementation of the WFP do not change from those described in Section 4.2. In the future, it is expected that groundwater use would continue throughout Sacramento County as defined for the Sacramento North, South Sacramento, and Galt Areas. While groundwater levels are expected to continue to decline, ultimate stabilization of the water table is projected under the sustainable yield recommendations of the WFP. Groundwater management throughout Sacramento County would be facilitated through maintaining basin-specific sustainable yields and through implementation of conjunctive use programs or similar efforts designed to maximize the efficient use of available surface water and groundwater supplies.

Impact **6.2-1**

Groundwater Quality. *Because groundwater pumping within Sacramento County does not change between the two comparative future conditions, the impacts identified with the implementation of the WFP do not change from those described in Section 4.2. Under the future cumulative condition, deterioration of groundwater quality would represent* ***a less-than-significant impact.***

Lowering of groundwater levels in the South Sacramento and Galt areas is associated with the up-rising of poorer quality water from the lower aquifer zone which then mixes with the water of the shallow aquifer zone. For the Sacramento North Area, no direct relationship between groundwater level decline and groundwater quality was observed from the available data. Thus, additional water level declines are not likely to significantly affect regional groundwater quality in the Sacramento North Area. In the South Sacramento and Galt areas, both manganese and arsenic have recently shown significant increases in average concentrations corresponding to a decline of 80 feet or more from pre-development conditions. It is anticipated that elevated levels of manganese and iron may occur in groundwater but at levels that would constitute an

aesthetic, rather than health-related effect. Arsenic levels are not expected to exceed current Title 22 standards. No standards for radon have yet been established.

Impact **6.2-2**

Movement of Groundwater Contaminants. *Under the future cumulative condition, movement of groundwater contaminants would not increase beyond that described for the WFP. This would be a* ***less-than-significant cumulative effect****.*

IGSM results showed that the rate of groundwater movement at each of the groundwater contamination sites increases with the additional groundwater level declines for the sites in the South Sacramento Area. The highest groundwater migration rate with the implementation of the recommended sustainable yields under the WFP, 662 feet/yr, is projected to occur at the Army Depot site located in the South Sacramento Area. This, however, would represent an increase in the rate of migration resulting from the WFP of 86 feet/yr. This increase in migration rate would not be instantaneous and would occur after groundwater levels have declined and stabilized. As such, the increase in migration rate that may occur each year over 20 to 30 years would be less than 5 feet/year for the Union Pacific site. As a result, no substantial increase in the rate of groundwater contaminant movement is expected.

Impact **6.2-3**

Land Subsidence. *Under the future cumulative condition, land subsidence would not occur beyond that described for the WFP. This would be a* ***less-than-significant impact.***

Throughout Sacramento County, the hydrogeologic substrata is not conducive to significant land subsidence. This has been supported by historic data relating observed land subsidence to past groundwater declines. While the WFP is anticipated to result in estimated land subsidence of generally less than one-half foot, the cumulative effect of all withdrawals from the existing groundwater aquifer on projected land subsidence will not differ measurably. Overall, the small magnitude of estimated land subsidence coupled with the fact that such estimates are projected over several decades, conclude that as a potential cumulative impact, land subsidence would be less than significant.

Impact **6.2-4**

Efficiency of Wells. *Under the future cumulative condition, efficiency of wells would not change beyond that described for the WFP. This would be a* ***less-than-significant impact****.*

This further lowering may result in reduced efficiency of existing groundwater wells. Groundwater levels are anticipated to continue to decline and ultimately stabilize under the sustainable yield recommendations of the WFP. This would include the need to: 1) deepen many existing wells, and 2) increase pumping at the deepened wells. Recognized as an economic rather than environmental impact, where the economic effects would exist as increased costs to well users, well efficiency from a cumulative environmental perspective would be a less-than-significant impact.

6.3 CUMULATIVE WATER SUPPLY IMPACTS

The cumulative impacts analysis is based on a set of assumptions about future cumulative conditions including implementation of the WFP and other reasonably foreseeable future actions. The analysis does not assume any development of additional Sacramento River supplies because no specific proposals are available Under this set of assumptions, the analysis indicates that annual deliveries to CVP and SWP customers could be reduced. Annual delivery shortfalls could be more frequent in the future as a result of the increase in competing demands on the system (i.e., consumptive uses and increasing environmental instream requirements). Accurate predictions at this time are not feasible, owing to the uncertainty of future operations. Current commitments, however, made by USBR and various public trust resource agencies in reconsidering and re-assessing the coordinated operations of the CVP as well as its implications on current and future ESA requirements, will dictate how the system will be allocated for future competing resource uses.

SWP contract demands associated with future 2030 development will be higher than current demands by approximately 600,000 AF on an annual basis. Consequently, one would expect to see, on average, greater SWP deliveries under the future cumulative scenario than the Base Condition. Future level cumulative condition hydrologic modeling indicates that reductions of SWP diversions are likely to occur in the driest years.

CVP contract demands associated with future development will also be higher than current demands, with average annual CVP delivery also higher, relative to today's condition. However, due to the increased overall demands on the system, it is likely that lower deliveries to all categories of CVP contractors could occur in the future, and be most significant in the dry and driest years. This would be particularly pronounced on agricultural contractors who, in the future, and depending on USBR's ultimate decision regarding their deficiency criterion, may experience significant shortfalls in deliveries, relative to current conditions.

Impact **6.3-1**

Decrease in Deliveries to SWP Customers. *Implementation of the future cumulative condition could result in increased deliveries to SWP customers of ranging between 20,000 and 1,240,000 acre-feet in 49 years; and, decreased water deliveries to SWP customers in 20 years of the 70-year record, ranging between 110,000 and 1,210,000 acre-feet. Average annual SWP deliveries would increase by about 350,000 acre-feet. The delivery reduction in 20 years would represent a* ***significant impact.***

SWP customers receive deliveries from the Feather River and the Delta. The Feather River service area customers received full deliveries (no deficiencies) in all years under the future cumulative and Base Condition simulations. Therefore, there are no impacts to SWP customers in this service area.

SWP customers dependent on water supplies from the Delta would, however, be subject to delivery reductions resulting from CVP/SWP operations under the future cumulative condition. Although the PROSIM modeling does not substitute deliveries to WFP purveyors from the SWP, the change in surplus Delta inflow caused by future cumulative conditions would result

in water availability differences to SWP contractors. Deliveries to SWP contractors are not distinguished by contract type in PROSIM, therefore, impacts reported are aggregate reductions in deliveries. Modeling results suggest that deliveries to the SWP will be significantly reduced during 20 years in the future when compared on a year to year basis with the Base Condition. This comparison, however, masks the fact that the SWP's increased delivery in one year can directly affect the SWP's ability to meet its demands in a succeeding year. Overall (annual average of 69-year record) the SWP would deliver about 350,000 acre-feet more water in the future cumulative condition when compared with the Base Condition. The significance criteria which identifies any yearly decrease as an impact does, nevertheless identify a significant impact to SWP water users.

Impact **6.3-2**

Decrease in Deliveries to CVP Customers. *Implementation of the future cumulative condition could result CVP water delivery increases ranging up to 670,000 acre-feet in 49 years of the 70-year record; and, decreases between 10,000 and 520,000 acre-feet in 20 years of 70-year record. Average annual CVP deliveries would increase by about 110,000 acre-feet. The delivery reduction in 20 years would represent a* ***significant impact****.*

Discussions of the effects of the future cumulative condition on CVP deliveries focuses only on the overall delivery changes to the CVP as a whole. The inability of USBR to meet all of its obligations in the future cumulative condition, evidenced by a Sacramento River water supply deficit of 600,000 acre-feet during the critical dry period, obscures identification of impacts to individual contractors. It is only appropriate to disclose that there would be less water delivered to CVP contractors, compared to the Base Condition, in 30% of the years despite the fact that CVP demands would increase in the future. In the 70% of years that deliveries increase, the change is largely caused by the growth in water demands. Reductions in deliveries would be a significant impact.

6.4 CUMULATIVE WATER QUALITY IMPACTS

Under the future (2030) cumulative condition, which includes the WFP and other reasonably foreseeable future system-wide actions (e.g., 2030 out-of-basin CVP/SWP demands, increased Sacramento Valley demands, and increased Trinity River flows), changes in water quality could occur in waterbodies of both the direct and indirect effect study areas. Seasonal impacts to water quality could occur as a result of increased surface water diversions and modified CVP operations that would result in lower reservoir storage and river flows. Lower volumes of water in both Folsom Reservoir and the Lower American and Sacramento rivers would provide less dilution for future levels of nutrient, pathogen, TDS, TOC, and priority pollutant loadings, which are anticipated to increase relative to existing levels due to planned urban growth within the region. Reduced Delta inflows could affect various water quality parameters within portions of the Delta.

This section provides a discussion of the potential water quality impacts that could occur in Folsom Reservoir, Lake Natoma, the Lower American River, the Sacramento River and the Delta under the future cumulative condition, relative to existing conditions.

Impact **6.4-1**

Lower American River and Folsom Reservoir Water Quality. *Under the future (2030) cumulative condition, which includes the WFP and other reasonably foreseeable future system-wide actions (e.g., 2030 out-of-basin CVP/SWP demands, increased Sacramento Valley demands, and increased Trinity River flows), Folsom Reservoir storage and Lower American River flows would be reduced more frequently and/or by greater magnitudes compared to that which would occur due to the WFP alone. Constituent loading to these waterbodies also would be expected to increase somewhat in the future, but such increases will be minimized by project-level urban runoff and stormwater discharge mitigation measures that will be required for planned growth to occur. With the exception of water temperature (see Section 6.5.3), program-level assessment indicated that any impacts to water quality from reduced dilution and increased constituent loading would be minor, and would not be expected to cause State or federal water quality standards, objectives or criteria to be more frequently exceeded, relative to existing conditions. This would be a* ***less-than-significant cumulative impact****.*

The primary water quality parameter anticipated to be affected in Folsom Reservoir, Lake Natoma, and the Lower American River under the future cumulative condition is water temperature. For a detailed discussion of cumulative temperature-related impacts in these waterbodies, see Section 6.5, Fisheries Resources and Aquatic Habitat.

Levels or concentrations for other water quality parameters of interest such as nutrients, pathogens, TDS, TOC, turbidity, and priority pollutants (e.g., metals, organics) would not be expected to be altered substantially, if at all, by reductions in Folsom Reservoir storage or Lower American River flows (i.e., dilution capacity). The changes in reservoir storage and river flows under the future cumulative condition would not differ substantially from that due to the additional diversions under the WFP alone. The future cumulative condition would have little effect on seasonal volumes of water maintained in Lake Natoma.

Additional loading of constituents into reduced water volumes could potentially degrade water quality. However, future increases in constituent loading will be minimized by project-level urban runoff and stormwater discharge mitigation measures that will be required for planned growth to occur. In addition, these waterbodies do not directly receive municipal wastewater discharges; hence, loading from this source would not change in the future. Hence, the future cumulative condition would not be expected to regularly cause substantial degradation of existing water quality in these waterbodies, nor would it be expected to cause State or federal water quality standards, objectives or criteria to be more frequently exceeded, relative to existing conditions.

Impact **6.4-2**

Sacramento River Water Quality. *Under the future (2030) cumulative condition, which includes the WFP and other reasonably foreseeable future system-wide actions (e.g., 2030 out-of-basin CVP/SWP demands, increased Sacramento Valley demands, and increased Trinity River flows), Sacramento River flows would be reduced more frequently and/or by greater magnitudes compared to that which would occur due to the additional diversions under the WFP alone. Constituent loading to the Sacramento River also would be expected to increase in the future. Future project-level water quality mitigation that will be implemented as urban growth occurs (i.e., mitigation measures to minimize*

additional loading from urban runoff and stormwater and effluent discharges) and ongoing water quality management plans and programs are expected to prevent State and federal water quality standards, objectives and criteria from being exceeded on a more frequent basis than currently occurs. However, substantial uncertainty exists with regard to seasonal changes in Sacramento River flow, constituent loading, and the extent and effectiveness of project-level water quality mitigation and management measures in the future, all of which are beyond the Water Forum's control. Because the potential for degradation of water quality in the future depends on uncertain future policy decisions and actions, this would be a ***potentially significant impact****.*

Seasonal reductions in Sacramento River flows are anticipated to occur as a result of the additional surface water diversions under the WFP along with other reasonably foreseeable future system-wide actions (e.g., 2030 out-of-basin CVP/SWP demands, increased Sacramento Valley demands, and increased Trinity River flows). Such flow reductions could cause additional warming in various reaches of the Sacramento River, relative to higher flow conditions, when ambient air temperatures are high (i.e., during the summer and fall months). Conversely, measurable temperature changes would generally not be expected to occur in the Delta. For a detailed discussion of cumulative temperature-related impacts in the Sacramento River, see Section 6.5.3, Fisheries Resources and Aquatic Habitat.

The flow reductions expected to occur in the Sacramento River under the future cumulative condition would reduce the dilution capacity of the river which, in turn, could result in elevated levels of certain constituents such as nutrients, pathogens, TDS, TOC, turbidity, and priority pollutants (e.g., metals, organics). However, river flow reductions of sufficient magnitude to cause measurable increases in various water quality constituents for a given rate of loading would be expected to occur infrequently. Higher rates of effluent discharge, urban runoff, and urban stormwater discharges to the Sacramento River would be expected to result from the planned development in the future that would be facilitated, in part, by the increased water supply made available by the WFP. However, increases in constituent loading are anticipated to be minimized by project-level urban runoff and stormwater and effluent discharge mitigation measures that will be required for planned growth to occur. Moreover, a number of regional plans and programs to address large-scale cumulative water quality impacts are in place or have recently been completed. Such plans/programs include, but are not limited to, the following:

- CALFED
- Sacramento River Coordinated Monitoring Program
- Sacramento River Watershed Program
- Sacramento County Stormwater Management Plan
- Triennial Review and Update of the Central Valley RWQCB Basin Plan
- NPDES Permitting Program
- CVRWQCB Ambient Monitoring Studies
- CVRWQCB Sacramento River Watershed Management Initiative
- Interagency Ecological Program Monitoring
- U.S. EPA Regional Environmental Monitoring and Assessment Program
- USGS Sacramento River Trace Metals Transport Studies
- USGS Sacramento River Basin National Water Quality Assessment Program
- SCRSD and EPA's Sacramento River Mercury Control Planning Project

- SWRCB Toxic Substances Monitoring Program
- USBR Upper Sacramento River Water Quality Monitoring Program
- DWR Municipal Water Quality Investigations Monitoring Program
- Cal EPA Department of Pesticide Regulation's Rice Pesticides Program
- 1995 Bay/Delta Water Quality Control Plan
- San Francisco Estuary Institute's Regional Monitoring Program for Trace Substances
- miscellaneous other watershed management plans and monitoring programs

Future actions implemented under the plans and programs identified above are anticipated to prevent significant cumulative impacts to Sacramento River and Delta water quality. However, substantial uncertainty exists with regard to seasonal changes in future Sacramento River flow and constituent loading, the extent and effectiveness of ongoing and future water quality management plans/programs and their actions, and the effectiveness of future project-level water quality mitigation measures associated with planned growth. Because of this extensive uncertainty, a definitive cumulative water quality impact determination cannot be made for the Sacramento River or Delta, based on available information. Although the actions anticipated to result from the numerous water quality monitoring and management plans/programs, coupled with project-specific mitigation measures that will be implemented as growth occurs, are anticipated to keep Sacramento River and Delta water quality changes to a minimum, the potential for water quality degradation in these waterbodies does exist. The realization of such impacts thus depends on uncertain future policy decisions and actions beyond the Water Forum's control.

6.5 CUMULATIVE FISHERIES RESOURCES AND AQUATIC HABITAT IMPACTS

This future cumulative impact assessment identifies the hydrologic and water temperature-related impacts to fisheries resources within water bodies of the direct and indirect effect study areas that could result from implementing the WFP and other future, system-wide diversion projects. Impact assessments are performed according to the impact assessment methodologies discussed above. Each potential impact is assigned a number, and is given a brief narrative title (underlined text), which is followed by a summary of impact assessment findings and the impact determination. Supporting data and its interpretation are provided below each impact determination.

Regarding the use of modeling output, it should be noted that the comparisons made under each numbered impact in this section are comparisons between the future cumulative condition (also referred to as the "2030 w/WFP") and existing conditions (also referred to as the "Base Condition"). For the purposes of this assessment, Reclamation's proposed temperature control device (TCD) for the urban water intake at Folsom Dam was included in the "2030 w/WFP" simulation, but not in the Base Condition simulation. This was done because the TCD is a reasonably foreseeable action that is expected to be in-place before Water Forum diversions increase to the levels modeled under the 2030 w/WFP, and because it does not physically exist today (i.e., is not a part of the Base Condition).

Long-term (i.e., 70 years for hydrologic parameters and 69 years for temperatures and salmon survival estimates) average values modeled for each month under the 2030 w/WFP and the Base Condition are summarized in tabular form in this section. Hydrologic, water temperature, and salmon mortality modeling output for individual years that were used to generate these long-term means, as well as numerous other statistical parameters generated from modeled data, can be found in Appendix J**.** This appendix is organized by sections that are numbered consistent with the impacts assessed in this section. For example, the assessment for Impact 6.5-1 is the first impact that relies on Folsom Reservoir storage data output from the PROSIM model. Thus, these output data are found in Section 1 of Appendix J. Finally, temperature and flow exceedance plots presented in this section, as well as similar plots for other river locations not presented in the EIR, are contained in Appendix J.

FOLSOM RESERVOIR

COLDWATER FISHERY

Impact **6.5-1**

Impacts to Folsom Reservoir's Coldwater Fisheries*. The cumulative impacts analysis is based on a set of assumptions about future cumulative conditions and does not assume any development of additional Sacramento River water supplies. Under this set of assumptions, the analysis indicates that Folsom Reservoir storage would be reduced by 10% or more, relative to the Base Condition, occasionally during some months of the April through November period. However, anticipated reductions in reservoir storage would not be expected to adversely affect the reservoir's coldwater fisheries because: 1) coldwater habitat would remain available within the reservoir during all months of all years; 2) physical habitat availability is not believed to be among the primary factors limiting coldwater fish populations; and 3) anticipated seasonal reductions in storage would not be expected to adversely affect the primary prey species utilized by coldwater fishes. This would be a* ***less-than-significant future cumulative impact.***

Additional diversions from Folsom Reservoir under the 2030 w/WFP would result in seasonal changes in end-of-month storage during most years. Seasonal changes in storage could result in corresponding changes in physical habitat availability for the reservoir's coldwater fish species. Lower reservoir storage could reduce, to some degree, the amount of space available for coldwater species to use during the April through November period, when strong thermal stratification occurs within the reservoir. Conversely, higher storage could increase the availability of coldwater fish habitat in the reservoir.

During the April through November period of the year, under 2030 w/WFP, reductions in the 70-year average end-of-month storage would range from approximately 3 to 7%, relative to mean monthly storage levels under the Base Condition (Appendix J). Reductions in reservoir storage of 10% or more during individual years, relative to the Base Condition, would occur occasionally during some months of the period (Appendix J). However, storage reductions of these magnitudes anticipated from limited water availability and increased demands by 2030 would not result in significant adverse effects to coldwater fisheries because the availability of physical habitat is not a primary limiting factor for these fishes. Food availability is a key factor affecting coldwater fish populations in the reservoir. However, the seasonal changes in reservoir

storage expected to occur under the 2030 w/WFP would not be expected to have substantial, if any, effects on the population dynamics of threadfin shad or wakasagi, which are the primary prey species for the reservoir's coldwater fish populations.

WARMWATER FISHERY

Impact **6.5-2**

Impacts to Folsom Reservoir's Warmwater Fisheries. *Under the set of assumptions used for the cumulative impacts analysis, Folsom Reservoir storage (and thus water levels) could frequently be reduced during the critical warmwater fish spawning and rearing period (i.e., March through September), which could reduce the availability of littoral (nearshore) habitat containing vegetation. Modeling output indicates that long-term average reductions in littoral habitat availability of up to approximately 50% could occur in September. Reductions in littoral habitat availability of this magnitude could result in increased predation on young-of-the-year warmwater fishes, thereby reducing long-term initial year-class strength of warmwater fishes. Unless willows and other nearshore vegetation become established at lower reservoir elevations in the future in response to seasonal reductions in water levels, long-term year class production of warmwater fishes would be reduced. Reduced littoral habitat availability would be a* ***potentially significant future cumulative impact*** *to Folsom Reservoir warmwater fisheries.*

Changes in the Seasonal Availability of Littoral Habitat

Additional diversions from Folsom Reservoir under the 2030 w/WFP would result in seasonal changes in end-of-month water surface elevation during most years, with the 70-year average monthly elevation being reduced, relative to that under the Base Condition, from approximately 2 to 4 feet during the March through September warmwater fish spawning and rearing period (Appendix J).

Changes in water surface elevation during the March through September period would result in corresponding changes in the availability of reservoir littoral habitat containing inundated terrestrial vegetation (e.g., willows). The 70-year average amount of littoral habitat potentially available to warmwater fishes for spawning and/or rearing in Folsom Reservoir would decrease during all months of the March through September period. Seventy-year average reductions in the availability of littoral habitat were estimated to range from approximately 5 to 50% during the March through September period (Appendix J). The average loss of approximately one-half of the reservoir's available littoral habitat containing vegetative structure during this period would be expected to reduce long-term year-class strength of warmwater fishes through resultant increases in predation losses of young-of-the-year fishes.

Changes in the Monthly Rates of Water Surface Elevation Fluctuation

Changes in Folsom Reservoir operations under the 2030 w/WFP would generally alter the rates at which reservoir surface elevations change during each month of the primary warmwater fish spawning period of the year (i.e., March through July). However, under the 2030 w/WFP, the potential for nest dewatering would change little, if at all, during all months of the March through July warmwater fish spawning period. (Appendix J). Changes in the potential for

significant nest dewatering events to occur during the March through July period would not be expected to have substantial adverse effects on annual year-classes of warmwater fishes in Folsom Reservoir.

LAKE NATOMA

Impact **6.5-3**

Impacts to The Warmwater and Coldwater Fisheries of Lake Natoma*. Under the specific set of cumulative assumptions, the analysis indicates that operations of Folsom Dam and Reservoir would have minimal, if any, impact to Lake Natoma's seasonal storage, rates of elevation fluctuation, or temperature. Any changes to these lake parameters that could occur under the future cumulative condition would not adversely affect the lake's warmwater or coldwater fisheries. This would be a* ***less-than-significant future cumulative impact.***

Because Lake Natoma serves as a regulating afterbay of Folsom Reservoir, it commonly experiences daily/weekly fluctuations in water surface elevations of approximately 4 to 7 feet. Hydrologic changes associated with the 2030 w/ WFP would not cause substantial changes in seasonal lake storage or water surface elevation fluctuations. Therefore, changes in use of surface and groundwater defined in the WFP would not directly affect the fisheries resources of Lake Natoma.

The 69-year average temperature of water released from Nimbus Dam under the 2030 w/WFP would be essentially equivalent to that under the Base Condition from December through May, but would be reduced up to about 1° F during the June through November period (Appendix J). These findings suggest that long-term average conditions in Lake Natoma could be somewhat improved for coldwater fishes during the June through November period, with temperatures being affected little during the remainder of the year. Spatial and temporal changes in water temperatures within Lake Natoma would not be expected to be sufficiently large to adversely affect the lake's warmwater fisheries.

NIMBUS FISH HATCHERY

Impact **6.5-4**

Temperature Impacts to Nimbus Fish Hatchery Operations and Fish Production. *Under the specific set of cumulative assumptions, the analysis indicates that operations of Folsom Dam and Reservoir would generally have little effect on May temperatures below Nimbus Dam, but would typically result in equivalent or colder temperatures during the June through September period, relative to the Base Condition. On a long-term basis, the frequent and measurable temperature reductions that would occur during the June through September period (when hatchery temperatures reach seasonal highs annually) would more than offset the infrequent adverse impacts resulting from increased temperature. This would potentially benefit long-term hatchery operations and resultant fish production. Overall, this would be a* ***less-than-significant future cumulative impact.***

Under the 2030 w/WFP, changes in the 69-year average water temperature at Nimbus Dam during the May through September period would range from less than measurable to reductions of about 1°F (Appendix J). Based on probability of exceedance, measurable temperature increases could occur up to 10% of the time during some months of this period. However,

measurable temperature decreases would occur at Nimbus Dam from over 40% to 95% of the time during June through September under the 2030 w/WFP (Appendix J). On a long-term basis, temperature decreases under the 2030 w/WFP more than offset the infrequent temperature increases.

LOWER AMERICAN RIVER

Flow- and temperature-related impacts are discussed separately below by species and lifestage. Organizationally, flow- and temperature-related impacts to fall-run chinook salmon are discussed first (Impact 6.5-5), followed by impact discussions for steelhead (Impact 6.5-6), splittail (Impact 6.5-7), American shad (Impact 6.5-8), and finally striped bass (Impact 6.5-9). Flow- and temperature-related impacts to fall-run chinook salmon and steelhead are discussed together.

Impact **6.5-5**

Fall-run Chinook Salmon. *The cumulative impacts analysis is based on a set of assumptions about future cumulative conditions and does not assume any development of additional Sacramento River water supplies. Under this set of assumptions, operations of Folsom Dam and Reservoir would result in periods of reduced flows in the lower American River during the October through December spawning period, when flows under the Base Condition would be 2,500 cfs or less. Further flow reductions occurring at already low flow levels could result in increased redd superimposition and eventual lower year-class strength. Improved water temperatures (resulting from a Folsom Dam urban water intake structure and optimal coldwater pool management) and improved early lifestage survival will benefit chinook salmon spawning success, as well as other lifestages. However, because of the broad, programmatic nature of the WFP, the extent to which these actions (combined with other future actions such as spawning gravel management, revised flow ramping rate criteria, etc.) will interact to counterbalance flow reductions is uncertain, as is the manner in which these actions will be implemented, managed and coordinated without a comprehensive Habitat Management Program Plan for the Lower American River. Consequently, the overall effect of 2030 w/ WFP on chinook salmon year-class strength also is uncertain and, therefore, is considered to represent a* ***potentially significant impact.***

Impact **6.5-6**

Lower American River Steelhead*. Under the cumulative analysis set of assumptions, flow reductions anticipated to occur during the April through September period would reduce the amount of juvenile rearing habitat in most years. The analysis also indicates that the 69-year average temperature at Nimbus Dam and Watt Avenue for the May through September period would decrease up to about 1°F. Although measurable temperature increases could occur in up to 10% of the years during this period, measurable temperature decreases could occur from over 30% to 95% of the time during some months of this period. Because steelhead in the Lower American River are believed to be more limited by summer rearing temperatures than flows, the frequent and substantial temperature reductions would be expected to offset the flow reductions. Consequently, the combined temperature and flow changes under the 2030 w/ WFP would not be expected to adversely affect the long-term population trends of steelhead in the Lower American River. This would be a* ***less-than-significant future cumulative impact.***

Flow-Related Impacts to Fall-Run Chinook Salmon and Steelhead Adult Immigration (September through March)

Flow-related impacts to chinook salmon adult immigration would primarily be dictated by the volume of flow at the mouth during the September through December period of the year, and for steelhead during the December through March period of the year. Under the 2030 w/WFP, the 70-year average flow at the mouth would decrease during all months of the September through March period (Appendix J). Although the 70-year average flow at the mouth during these months would be reduced under the 2030 w/WFP, relative to flows under the Base Condition, the 70-year average Sacramento River flow at Freeport also would be reduced during this period (Appendix J). Under the 2030 w/WFP, the greatest reduction in the 70-year average proportion of Sacramento River flow immediately downstream of the mouth that would be composed of American River water during the September through March period (the combined primary period of upstream adult immigration for chinook salmon and steelhead) would be on the order of about 3 to 4%. Hence, although mean monthly Lower American River flows at the mouth under the 2030 w/WFP would decrease during each month of this period, relative to the Base Condition, these reductions would not be expected to adversely affect the long-term homing ability of immigrating adult fall-run chinook salmon or steelhead.

Temperature-Related Impacts to Fall-Run Chinook Salmon and Steelhead Adult Immigration (September through March)

The 69-year average water temperatures at the mouth of the Lower American River and at Freeport on the Sacramento River, under the 2030 w/WFP, would be equivalent to or colder than those under the Base Condition during all months of the September through March period, with measurable decreases in the 69-year average temperature potentially occurring during some months (Appendix J).

Although Reclamation's Lower American River Temperature Model does not account for the influence of Sacramento River water intrusion on water temperatures at the mouth, this bias would be similar among alternatives. Therefore, the remaining temperature assessments are based on temperatures modeled at the mouth of the Lower American River.

During the December through March period, water temperatures at the confluence under the 2030 w/WFP would typically remain sufficiently cool (see Appendix J) to not impact fall-run chinook salmon or steelhead immigration. In addition, based on probability of exceedance, temperatures under the 2030 w/WFP during these months are generally equivalent to or colder than temperatures under the Base Condition (Appendix J).

Based on probability of exceedance, temperatures at the mouth during the September through November period under 2030 w/ WFP would increase measurably, compared to the Base Condition, up to about 10% of the time, but would decrease from over 30% to over 65% of the time (Appendix J). Thus, September through March water temperatures in the lower portion of the Lower American River under the 2030 w/WFP would be expected to have long-term beneficial effects on fall-run chinook salmon adult immigration, and would have no adverse effect on steelhead adult immigration.

Flow- and Temperature-Related Impacts to Fall-run Chinook Salmon Spawning and Incubation (October through February)

Flow-Related Impacts

The 70-year average flow below Nimbus Dam under the 2030 w/WFP would be reduced by approximately 4 to 5% during each month of the October through February period, relative to flows under the Base Condition (Appendix J). The additional diversions that would occur between Nimbus Dam and Watt Avenue under the WFP range from approximately 10 cfs to 30 cfs, depending on the month of the year. Hence, changes in long-term average flows under the 2030 w/WFP for each month of the October through February period are essentially the same at Watt Avenue as those reported above for Nimbus Dam.

Substantial flow reductions could occur frequently at Nimbus Dam under 2030 w/ WFP, relative to the Base Condition, during the October through February period. When flows under the Base Condition are at or below 2,500 cfs, which is the wet year flow objective in the AFRP for this period, flows would be substantially reduced from approximately 30 to over 40% of the time. Findings are essentially the same at Watt Avenue (Appendix J). Thus, during the October through December portion of this period (when the majority of fall-run chinook salmon spawning occurs annually), 2030 w/WFP could relatively frequently reduce flows, and the initial year-class size of lower American River fall-run chinook salmon could potentially be reduced (due to increased redd superimposition) during some of the years when lower spawning flows are provided.

Temperature-Related Impacts

Under the 2030 w/WFP, changes in the 69-year average water temperature at Nimbus Dam and Watt Avenue during the October through February period would range from less than measurable to a reduction of about 1°F (Appendix J). During October and November, temperatures at Nimbus Dam and Watt Avenue would increase measurably, compared to the Base Condition, up to about 10% of the time, based on the probability of exceedance (Appendix J). However, measurable temperature decreases would occur at Nimbus Dam and Watt Avenue up to approximately 75% of the time.

During the December through February portion of this period, temperatures throughout the Lower American River would remain sufficiently cool as to not impact fall-run chinook salmon spawning and incubation success. In addition, temperatures under 2030 w/ WFP during these months are generally equivalent to or colder than those under the Base Condition.

Finally, the 69-year average annual early lifestage survival (percent survival of emergent fry from egg potential) for fall-run chinook salmon would increase from approximately 84% under the Base Condition to approximately 86% under the 2030 w/WFP, an average increase of about 2% (Appendix J). Thus, temperatures in the river under the 2030 w/WFP during the October through February period would have beneficial effects on spawning and incubation of fall-run chinook salmon.

Flow- and Temperature-Related Impacts to Steelhead Spawning and Incubation (December through March)

No flow- or temperature-related impacts to steelhead spawning or incubation would be expected to occur under the future cumulative condition. For quantitative flow data supporting this impact determination, see Appendix J, Sections 6 and 7. For the quantitative temperature data supporting this impact determination, see Appendix J, Sections 5 and 9.

Flow- and Temperature-Related Impacts to Fall-run Chinook Salmon and Steelhead Juvenile Rearing (March through June)

Flow-Related Impacts

Under the 2030 w/WFP, the 70-year average flow at Watt Avenue would be reduced about 4 to 8% in all months of the March through June period, relative to the Base Condition (Appendix J).

In general, under the 2030 w/ WFP, the probability of mean monthly flows exceeding 4,500 cfs would not change substantially during the March through June period, relative to the Base Condition. Under 2030 w/ WFP, flow reductions would occur frequently in some months and regularly in others, based on probability of exceedance, when flows would be at or below 4,500 cfs under the Base Condition, which is the wet-year flow objective in the AFRP for this period. For this period, 2,000 cfs is the dry and critical flow objective in the AFRP. When flows under the Base Condition are 2,000 cfs or less, measurable flow reductions would only occasionally occur during March, but more substantial flow reductions would more frequently occur during April through June. Over the long-term, flow reductions under 2030 w/ WFP wouldn't be expected to substantially alter the quantity or quality of rearing habitat, partly because the primary period of emigration occurs from mid-February through early March. However, flow reductions when flows are already at relatively low levels may adversely affect rearing success during those years.

Temperature-Related Impacts Assessment

Under the 2030 w/WFP, changes in the 69-year average water temperature at Watt Avenue during the March through June period would range from less than measurable to a reduction of less than 1°F (Appendix J). During the March through June period, temperatures at Watt Avenue under 2030 w/ WFP would increase measurably, based on the probability exceedance, up to about 15% of the time (Appendix J) during some months, with temperatures under 2030 w/ WFP remaining similar to or cooler than the Base Condition the rest of the time. However, because the primary period of emigration occurs from mid-February through early March, and because temperatures during March under 2030 w/ WFP would remain below 60°F, the majority of emigrants would not be affected by these infrequent increases in temperature. In addition, the frequency and magnitude of temperature increases that would occur from April through June would not be expected to impact the long-term rearing success of juveniles that remain in the river during these months. Furthermore, 2030 w/ WFP would provide improved

temperature conditions approximately 50% of the time during June, based on the probability of exceedance, which could benefit late-emigrating juveniles.

The temperature changes discussed above for the March through June period would affect juvenile emigration upstream of Watt Avenue in a manner similar to effects on rearing. Temperature-related impacts to fish emigrating through the lower river (i.e., downstream of Watt Avenue) are assessed based on temperatures at the mouth (see discussion below).

Flow-Related Impacts to Fall-Run Chinook Salmon and Steelhead Juvenile Emigration (February through June)

The primary period of fall-run chinook salmon juvenile emigration occurs from February through June, with the majority of juvenile steelhead emigration occurring during this same period. Generally little, if any, emigration occurs during July and August. Flow-related impacts to salmonid immigration (discussed above) addressed flow changes in February and March. The changes in flows under the 2030 w/WFP during February and March would not be sufficient to adversely affect juvenile fall-run chinook salmon or steelhead emigration. Hence, this discussion will focus primarily on the April through June period of the year.

Adequate flows for emigration from the portion of the river above Watt Avenue would be met by flows which were previously discussed under this impact section (see discussions regarding rearing). Bypass flows at the mouth are used to assess potential flow-related impacts to salmonid emigration through the lower river (i.e., below Watt Avenue).

Under the 2030 w/WFP, the 70-year average flow at the mouth would decrease by over more than 10% to nearly 20% during all months of the April through June period. Flows at the confluence would be reduced much of the time during all months, with substantial reductions in flow at the confluence often occurring (Appendix J). Flows under the 2030 w/WFP would never be reduced to levels that would physically block emigration from the river, when such flow levels would not exist under the Base Condition.

Higher flows and turbidity have been shown to result in higher rates of downstream juvenile emigration. However, much of this information comes from findings associated with large pulse flows following significant precipitation events, not relatively small changes in flow on the order of 10 to 20%. Moreover, high flow and turbidity levels, although known to trigger emigration events, are not necessary for successful emigration of a salmonid year-class from the river. Consequently, although substantial flow reductions would occur periodically under the 2030 w/WFP during the April through June period, relative to flows under the Base Condition, resultant flows would not be expected to adversely affect the long-term success of juvenile salmonid emigration.

Temperature-Related Impacts to Fall-Run Chinook Salmon and Steelhead Juvenile Emigration (February through June)

With the possible exception of a small percentage of fish that may rear near the mouth of the Lower American River, impacts of river temperatures at the mouth to fall-run chinook salmon and steelhead would be limited to the [up to] several days that it takes emigrants to pass through the lower portion of the river and into the Sacramento River in route to the Delta.

The 69-year average water temperatures expected to occur at the mouth during February and March have been discussed previously under impacts to adult salmonid immigration. Water temperatures at the mouth under the 2030 w/WFP would generally be similar to those under the Base Condition during February and March and would generally be cool enough as to not be of concern to juvenile emigration (Appendix J).

The 69-year average temperatures would not be expected to change measurably under the 2030 w/WFP, relative to the Base Condition during the period April through June (Appendix J). Based on the probability of exceedance, temperatures at the confluence during this period would increase measurably, compared to the Base Condition, up to about 35% of the time (Appendix J) during some months, with temperatures under 2030 w/ WFP remaining similar to or cooler than the Base Condition the rest of the time. Based on the probability of exceedance, temperatures would be measurably cooler approximately 50% of the time in June. Overall, increases in water temperatures that would be expected to occur at the mouth in some years under the 2030 w/ WFP would not occur with sufficient frequency, or be of sufficient magnitude, to adversely affect long-term emigration success of fall-run chinook salmon or steelhead during April, May or June. The more frequent reductions in temperatures at the mouth during June would have beneficial effects on late-emigrating juvenile fall-run chinook salmon and steelhead.

Flow-Related Impacts to Steelhead Rearing (year-round)

During the July through September period, fall-run chinook salmon are not in the river. July through September is generally considered to be the critical summer rearing period for steelhead in the Lower American River.

During the July through September period (Appendix J), flows at Nimbus Dam and Watt Avenue, under the 2030 w/WFP, would typically be reduced in most years, with reductions generally ranging from about 200 to 500 cfs, with more substantial reductions occurring in some years. Under 2030 w/ WFP, substantial flow reductions would occur frequently, when flows are at or below 2,500 cfs under the Base Condition, which is the wet year summer flow objective in the AFRP. Based on the probability of exceedance, flows at Nimbus Dam and Watt Avenue would be 2,500 cfs or lower under the Base Condition approximately 40 to 60% of the time, and 2,500 cfs or lower about 45 to 70% of the time under 2030 w/ WFP.

Temperature-Related Impacts to Steelhead Rearing (year-round)

Under the 2030 w/WFP, changes in the 69-year average water temperature at Nimbus Dam and Watt Avenue during spring and the critical summer rearing period would range from less than measurable to reductions of about 1°F. Based on the probability of exceedance, measurable temperature increases could occur in up to 10% of the time during some months of this period. However, based on the probability or exceedance, measurable temperature decreases would occur at Nimbus Dam and Watt Avenue from over 30% to 95% of the time during June through September under the 2030 w/WFP (Appendix J). Temperature changes under the 2030 w/WFP would, on a long-term basis, have a beneficial effect on steelhead summer rearing in the Lower American River.

SPLITTAIL

Impact **6.5-7**

Flow- and Temperature-Related Impacts to Splittail (February through May). *Under the cumulative analysis assumptions, the 2030 w/ WFP would typically reduce, to some degree, the amount of riparian vegetation inundated between RM 8 and 9 (which serves as an index for the lower portion of the river) under the Base Condition. However, with few exceptions, substantial amounts of inundated riparian vegetation would remain under the 2030 w/WFP in years when such habitat would occur under the Base Condition. In addition, flow changes under the 2030 w/WFP would have little effect on the availability of in-channel spawning habitat availability, or the amount of potential spawning habitat available from the mouth up to RM 5 – the reach of the river influenced by Sacramento River stage. The analysis also indicates that the frequency with which suitable temperatures for splittail spawning below Watt Avenue would not change substantially under the 2030 w/WFP, relative to the Base Condition. Given the uncertainty as to the magnitude and extent of splittail spawning in the Lower American River, and the actual amount of potential spawning habitat at specific flow rates throughout the river, the effects of flow reductions from the February through May period also are uncertain and, therefore, represent a potentially significant impact. This would be a* ***potentially significant future cumulative impact****.*

Under the 2030 w/WFP, the 70-year average flows at Watt Avenue would be reduced by about 4 to 5% during each month of the February through May period, relative to flows under the Base Condition.

Using flows at Watt Avenue, the acreage of riparian vegetation inundated between RM 8 and 9 was used as an index of the relative amount of inundated riparian vegetation that would occur in the lower portion of the river for a given flow rate. Under the 2030 w/ WFP, the amount of riparian habitat inundated in this portion of the river would remain unchanged from about nearly 70% to 80% of the years, relative to the Base Condition. However, in most of these years, no riparian vegetation would be inundated under either the 2030 w/ WFP or the Base Condition.

With the exception of March when the amount of inundated riparian habitat would increase about 1% more often, the amount of such habitat between RM 8 and 9 would be reduced to some degree under the 2030 w/ WFP in the years when riparian habitat would be inundated

under the Base Condition. Reductions of more than 20% in the relative amount of inundated habitat between RM 8 and 9 would occur about 3 to 9% of the time during the February through May period under the 2030 w/ WFP, relative to that which would be inundated under the Base Condition. Based on the number of years when riparian habitat would be inundated under the Base Condition, these habitat reductions of 20% or more would occur from about 9% to about 40% of the years during this period that such habitat would exist under the Base Condition. Nevertheless, in most of these years, substantial amounts of inundated riparian habitat would remain available under the 2030 w/ WFP. Complete (i.e., 100%) losses of available habitat under the Base Condition would occur up to about 5% of the time during the February through May period. Increases in the availability of inundated riparian vegetation would occur approximately 1% of the time during March.

The number of years that mean monthly water temperatures at Watt Avenue would be within the preferred range for splittail spawning of 48°F to 68°F would not change substantially, if at all, during each month of the February through May period.

AMERICAN SHAD

Impact **6.5-8**

Flow- and Temperature-Related Impacts to American Shad (May and June). *Under the cumulative analysis assumptions, flow reductions anticipated to occur during the May through June period would increase the frequency with which mean monthly flows at the mouth would be below the target attraction flow of 3,000 cfs by about 3 to 4%. Flow reductions under the 2030 w/WFP in May and June could reduce the number of adult shad attracted into the river during a few years. However, because American shad spawn opportunistically where suitable conditions are found, potentially attracting fewer adults spawners into the Lower American River in some years would not be expected to adversely impact annual American shad production within the Sacramento River system. Furthermore, direct impacts to the Lower American River sport fishery would be less than substantial in most years. In addition, the frequency with which suitable temperatures for American shad spawning would exist would not differ substantially between the 2030 w/WFP and the Base Condition. Consequently, the combined flow and temperature changes under 2030 w/WFP would not be expected to adversely affect the long-term population trends of American shad in the Lower American River. This would be a* ***less-than-significant future cumulative impact.***

Changes in Lower American River flows that could be expected to occur during May and June under the 2030 w/ WFP have been discussed previously under Impact 6.5-5 (Appendix J). In addition to this analysis, an additional analysis was performed to determine the probability that lower American River flows at the mouth would be below 3,000 cfs, the flow level defined by CDFG as that which would be sufficient to maintain the sport fishery. Under the 2030 w/ WFP, mean monthly flows would be below the 3,000 cfs attraction flow at the mouth approximately 4 to 6% more often during the May through June period (Appendix J).

The number of years that mean monthly water temperatures at Nimbus Dam and the mouth would be within the preferred temperature range for American shad spawning of 60°F to 70°F would not change substantially during the May through June period. Lower American River

water temperatures under the 2030 w/ WFP would remain suitable for American shad rearing (Appendix J).

STRIPED BASS

Impact 6.5-9

Flow- and Temperature-Related Impacts to the Striped Bass Sport Fishery (May and June). *Under the cumulative analysis assumptions, flow reductions anticipated to occur during the May through June period would increase the frequency with which mean monthly flows at the mouth would be below the target attraction flow of 1,500 cfs by about 1 to 10%. However, flows at the mouth that are believed to be sufficient to maintain the striped bass fishery would be met or exceeded in most years during this period. The frequency with which suitable temperatures for juvenile striped bass rearing in the Lower American River would differ little between the 2030 w/ WFP and the Base Condition during May and June. Consequently, the combined temperature and flow changes under the 2030 w/ WFP would not be expected to adversely affect the long-term of the striped bass fishery in the lower American River. This would be a* ***less-than-significant future cumulative impact.***

Changes in Lower American River flows that could be expected to occur during May and June under the 2030 w/ WFP have been discussed previously under Impact 6.5-5 (Appendix J). In addition to this analysis, an additional analysis was performed to determine the probability that Lower American River flows at the mouth would be below 1,500 cfs, the flow level defined by CDFG as that which would be sufficient to maintain the sport fishery. Under the 2030 w/ WFP, mean monthly flows in the Lower American River would be below the 1,500 cfs attraction flow threshold at the mouth about 6 to 9% more often during May and June, relative to the Base Condition.

The number of years that mean monthly water temperatures at Nimbus Dam would be within the preferred range for striped bass juvenile rearing of 61°F to 73°F would not change substantially during May and June (Appendix J).

SHASTA AND TRINITY RESERVOIRS

COLDWATER FISHERIES

Impact 6.5-10

Impacts to Shasta Reservoir's Coldwater Fisheries. *Under the cumulative analysis assumptions, substantial reductions in reservoir storage would occur occasionally throughout the April through November period of the year. However, because physical habitat availability is not believed to be among the primary factors limiting coldwater fish populations within the reservoir, and because anticipated changes in seasonal storage would not be expected to result in substantial adverse effects on the primary prey base utilized by the reservoir's coldwater fish populations, seasonal reductions in storage expected to occur under 2030 w/ WFP would not significantly affect Shasta Reservoir's coldwater fisheries. This would represent a* ***less-than-significant future cumulative impact.***

Hydrologic conditions with the 2030 w/ WFP would reduce the 70-year average monthly storage in Shasta Reservoir, relative to the Base Condition, by approximately 1 to 4% during

all months of the April through November period. Reductions in Shasta storage of more than 10% would occur occasionally during all months of this period. The changes in Shasta Reservoir storage expected to occur under the 2030 w/ WFP would not be expected to substantially affect the coldwater fishery as the availability of physical habitat is not a primary limiting factor for these fish. In addition, the storage reductions would not adversely affect the population dynamics of the primary prey species for the reservoir's coldwater fish populations (Appendix J).

Impact **6.5-11**

Impacts to Trinity Reservoir's Coldwater Fisheries. *Under the cumulative analysis assumptions, substantial reductions in reservoir storage would occur occasionally throughout the April through November period of the year. However, because physical habitat availability is not believed to be among the primary factors limiting coldwater fish populations within the reservoir, and because anticipated changes in seasonal storage would not be expected to result in substantial adverse effects on the primary prey base utilized by the reservoir's coldwater fish populations, seasonal reductions in storage expected to occur under 2030 w/ WFP would not substantially affect Trinity Reservoir's coldwater fisheries. This would represent a* ***less-than-significant future cumulative impact.***

Hydrologic conditions with the 2030 w/ WFP would reduce the 70-year average monthly storage in Trinity Reservoir, relative to the Base Condition, by approximately 3 to 6% during all months of the April through November period. Reductions in Trinity storage of more than 10% would occur occasionally within individual years during all months of this period. However, these anticipated changes in mean monthly reservoir storage would not be expected to substantially affect the coldwater fishery as the availability of coldwater fish habitat is not a primary limiting factor for those fish. The storage reductions also would not adversely affect the population dynamics of the primary prey species utilized by the reservoir's coldwater fish populations (Appendix J).

WARMWATER FISHERIES

Impact **6.5-12**

Impacts to Shasta Reservoir's Warmwater Fisheries*. Under the cumulative analysis assumptions, the 70-year average amount of littoral habitat available to warmwater fishes would be reduced by about 11 to 36% during the July through September period (which are the initial rearing months for the reservoir's warmwater fishes of management concern), with even more substantial reductions in reservoir littoral habitat availability in some years during these months. Rates of elevation fluctuation would not change substantially under the 2030 w/ WFP, relative to the Base Condition. However, seasonal changes in 70-year average reservoir littoral habitat under the 2030 w/ WFP would be of sufficient magnitude to potentially affect long-term, average initial year-class strength of the warmwater fish populations of management concern. Reduced littoral habitat availability would be a* ***potentially significant future cumulative impact*** *to Shasta Reservoir warmwater fisheries.*

Littoral Habitat Availability

The additional diversion demand on the American River system and the Sacramento River under the 2030 w/ WFP would reduce the 70-year average end-of-month water surface elevation in Shasta Reservoir by about 2 to 5 feet during the March through September period.

Reductions in average end-of-month elevation of greater than 1 ft would regularly occur during the all months of the March through September period (when warmwater fish spawning and initial rearing occurs) (Appendix J). Changes in water surface elevation in Shasta Reservoir during the March through September period would result in corresponding changes in the availability of reservoir littoral habitat containing inundated terrestrial vegetation (e.g., willows and button brush). Such shallow, near-shore waters containing physical structure are important to producing and maintaining strong year-classes of warmwater fishes annually.

Reductions in the 70-year average amount of littoral habitat potentially available to warmwater fishes for spawning and/or rearing in Shasta Reservoir under the 2030 w/ WFP would be substantial during some months. Reduction in 70-year average amount of littoral habitat would range from about 3 to 6% during the March through June period, but would range from about 11 to 36% during the period July through September (Appendix J). Thus, on the average, littoral habitat would be reduced over 20% from July through September. More substantial reductions in littoral habitat availability would occur frequently during individuals years of the March through September period. These changes in the availability of littoral habitat, under 2030 w/ WFP, would suggest that such reductions would be likely to adversely affect the long-term initial establishment of warmwater fish year-classes.

Potential for Dewatering Events

Changes in CVP/SWP operations under the 2030 w/ WFP could alter the rates by which water surface elevations in Shasta Reservoir change during each month of the primary warmwater fish spawning period of the year (i.e., March through July). Modeling results indicate that under the 2030 w/ WFP the frequency with which potential nest dewatering events could occur in Shasta Reservoir would change little, if at all, relative to the Base Condition, during some months of the March through July period, with a minor increase in frequency in others.

Impact **6.5-13**

Impacts to Trinity Reservoir's Warmwater Fisheries*. Under the cumulative analysis assumptions, littoral habitat availability would be reduced by about 10 to about 20% during the March through September period, with substantial reductions in littoral habitat availability occurring frequently throughout period. On the average, the 70-year average littoral habitat would be reduced by nearly 20% from July through September. The potential for nest dewatering events to occur in Trinity Reservoir would not change substantially under the 2030 w/ WFP during the March through July spawning period. However, changes in the availability of littoral habitat under the 2030 w/ WFP would potentially result in adverse affects to the initial establishment of warmwater fish year-classes. Reduced littoral habitat availability would be a* ***potentially significant future cumulative impact*** *to Trinity Reservoir warmwater fisheries.*

Littoral Habitat Availability

The additional diversion demand on the American River system and the Sacramento River under the 2030 w/ WFP would reduce the 70-year average end-of-month water surface elevation in Trinity Reservoir by about 5 to over 8 ft during the March through September period (Appendix J). During the March through September period (when warmwater fish spawning

and initial rearing occurs), reductions in average end-of- month elevation of greater than 1 ft would often occur during the March through September period.

Changes in water surface elevation in Trinity Reservoir during the March through September period would result in corresponding changes in the availability of reservoir littoral habitat containing inundated terrestrial vegetation (e.g., willows and button brush). Reduction in 70-year average amount of littoral habitat would range from less than 10 to nearly 20% during the period March through September (Appendix J). On the average, average littoral habitat would be reduced by approximately 18% from July through September. Substantial reductions in littoral habitat availability would frequently occur in Trinity Reservoir under the 2030 w/ WFP, relative to the Base Condition.

Potential for Nest Dewatering Events

Changes in CVP/SWP operations under the 2030 w/ WFP could alter the rates at which water surface elevations in Trinity Reservoir change during each month of the primary warmwater fish spawning period of the year (i.e., March through July). However, modeling results indicate that the frequency with which potential nest dewatering events could occur in Trinity Reservoir under the 2030 w/ WFP, relative to that under the Base Condition, would not change substantially during any month of the warmwater fish spawning period of the year (i.e., March through July) (Appendix J).

KESWICK RESERVOIR

Impact **6.5-14**

Impacts to Keswick Reservoir Fisheries. *Under the cumulative impact assumptions, hydrologic conditions with the 2030 w/ WFP would have little, if any, effect on seasonal storage, elevation, and temperature of Keswick Reservoir. Any minor changes in storage, elevation, or temperature that could occur would not substantially affect the reservoir's fishery resources. This would constitute a* ***less-than-significant future cumulative impact.***

No storage-, elevation-, or temperature-related impacts to the fishery resources of Keswick Reservoir would be expected to occur because, as a regulating afterbay of Shasta Reservoir, its monthly storage, elevation, and temperature would be expected to remain similar under the 2030 w/ WFP to that which currently exists under the Base Condition.

UPPER AND LOWER SACRAMENTO RIVER

Impact **6.5-15**

Flow-Related Impacts to Sacramento River Fisheries*. Under the cumulative analysis assumptions, the 70-year average flows released from Keswick Dam would not be substantially reduced during any month of the year. The analysis indicates that flow reductions of more than 10% would occur occasionally during some months and infrequently during others under 2030 w/ WFP, relative to the Base Condition. The analysis also indicates that the 3, 250 cfs minimum flow objective for Keswick Reservoir stipulated in the NMFS Biological Opinion for the protection of winter-run chinook salmon rearing and downstream passage between 1 October and 31 March would not be violated in any month of this period*

under either the 2030 w/ WFP or the Base Condition. Flow changes below Keswick Dam that would occur under the 2030 w/ WFP would result in less-than-significant impacts to upper Sacramento River fisheries resources. The analysis for the lower Sacramento River indicates that the 70-year average flows under 2030 w/ WFP would not be substantially reduced relative to the Base Condition. The analysis also indicates that flow reductions of more than 20% would occur occasionally during August and infrequently during all other months of the year. Consequently, any flow-related impacts to lower Sacramento River fisheries or migrating anadromous fishes that could occur under 2030 w/ WFP are considered to be less than significant. Overall, this constitutes a ***less-than-significant future cumulative impact.***

Flow-Related Impacts in the Upper Sacramento River

Under the 2030 w/ WFP, the 70-year average flow released from Keswick Dam would not be substantially reduced during any month of the year, with changes in the 70-year average flow ranging from an increase of about 1% to reductions of about 5%. Reductions of more than 10% in releases from Keswick Dam would occur occasionally during some months and infrequently during others throughout the yearly period (Appendix J). Reductions of more than 20% in releases from Keswick Dam would occur infrequently, if at all, during all months throughout the yearly period (Appendix J).

The minimum flow objective for Keswick Dam release stipulated in the NMFS Biological Opinion for the protection of winter-run chinook salmon rearing and downstream passage is 3,250 cfs between 1 October and 31 March. Modeling output shows that mean monthly flows below Keswick Dam would never be below 3,250 cfs in any month of the October through March period in any of the 70 years modeled under either the 2030 w/ WFP or the Base Condition (Appendix J).

Flow-Related Impacts in the Lower Sacramento River

The 70-year average flow at Freeport under the 2030 w/ WFP would be reduced by less than 5%, relative to flows under the Base Condition, during all months. Flow reductions of 1% to 10% would occur regularly in individual years during all months. Flow reductions 10% or more would occur infrequently during the November through May period, but more frequently during the June through October period. Flow reductions of 20% or more would occur infrequently during all months except August, when flow reductions of 20% or more would occur occasionally (Appendix J). Therefore, because substantial and frequent reductions in lower Sacramento flows would not occur, neither physical habitat availability for fishes residing in the lower Sacramento River nor immigration of adult or emigration of juvenile anadromous fishes would be substantially affected under the 2030 w/ WFP, relative to the Base Condition.

Impact **6.5-16**

Temperature-Related Impacts to Sacramento River Fisheries Resources*. Under the cumulative analysis assumptions, the 69-year average temperature at Keswick Dam would increase up to approximately one-half °F during the period August through November. Mean monthly temperatures at Keswick Dam would exceed the 56°F threshold stipulated in the NMFS Biological Opinion for winter-run chinook salmon about 1% more often in September,*

and would exceed the 60°F threshold stipulated for October in the NMFS Biological Opinion for winter-run chinook salmon 1% more often under the 2030 w/ WFP, relative to the Base Condition. Mean monthly temperatures at Bend Bridge would exceed the 56°F threshold stipulated in the NMFS Biological Opinion for winter-run chinook salmon approximately 1% more often in April, and approximately 3% more often in May, June, and August. Although there would be no substantial change in the 69-year average early lifestage salmon survival for fall-, late fall-, winter-, and spring- run chinook salmon, substantial reductions in annual early-lifestage survival could be expected to occur under the 2030 w/ WFP, relative to annual survival estimates under the Base Condition, approximately 6% more often for winter-run and approximately 1 to 3% more often for spring-run. Substantial changes in average lower Sacramento River temperatures would not be expected over the 69-year period simulated, although individual months could exhibit substantial temperature increases. Overall changes in water temperatures represent a ***significant future cumulative impact.***

Temperature-Related Impacts in the Upper Sacramento River

The 69-year average water temperatures below Keswick Dam under the 2030 w/ WFP would not change substantially, or would be slightly reduced, compared to the Base Condition, during the December through July period. Conversely, the 69-year average temperature would increase up to approximately one-half °F during the period August through November. Under the 2030 w/ WFP, the 69-year average temperatures at Keswick Dam would remain well below 56°F during all months of the year (Appendix J).

An assessment of the 69 individual years modeled indicates that, with the exception of the 56°F threshold being exceeded 3% of the time in March (as opposed to 1% of the time under the Base Condition), mean monthly temperatures below Keswick Dam under 2030 w/ WFP would always be 56°F or lower during the December through July period (Appendix J).

Under the 2030 w/ WFP, mean monthly temperatures at Keswick Dam would not exceed the 56°F threshold stipulated in the NMFS Biological Opinion for winter-run chinook salmon in any additional years in August, but would exceed 56°F 1% more often in September. In addition, under the 2030 w/ WFP, the 56°F threshold would be exceeded 3% more often in October and 1% more often in November, relative to that under the Base Condition. Mean monthly temperatures under 2030 w/ WFP would be below 60°F in all years during November. Finally, mean October temperatures at Keswick Dam would exceed the 60°F threshold stipulated for this month in the NMFS Biological Opinion for winter-run chinook salmon 1% more often under the 2030 w/ WFP, relative to the Base Condition (Appendix J).

With the exception of the 56°F threshold being exceeded about 1% of the time in March and 3% of the time November, mean monthly water temperatures at Bend Bridge, under the 2030 w/ WFP, would be at or below 56°F under in all years during the November through March period. Mean monthly temperatures at Bend Bridge would exceed the 56°F threshold stipulated in the NMFS Biological Opinion for winter-run chinook salmon approximately 1% more often in April, and approximately 3% more often in May, June, and August, with no change in the frequency of exceeding 56°F in July and September (Appendix J). The 60°F threshold would

be exceeded 1% less often at Bend Bridge under 2030 w/ WFP, relative to that under the Base Condition (Appendix J).

Mean monthly temperatures at Jelly's Ferry would exceed the 56°F threshold stipulated in the NMFS Biological Opinion for winter-run chinook salmon approximately 3% more often in May, 1% less often in June, and 1% more often in July, August, and September (Appendix J). There would be no change in the probability of exceeding the 60°F threshold at Jelly's Ferry during October under 2030 w/ WFP, relative to that under the Base Condition, (Appendix J).

The 69-year average early lifestage survival for the fall-, late fall-, spring-, and winter-runs of Sacramento River chinook salmon would not substantially change (less than 2%). However, substantial reductions (ranging from over 10% to 60%) in annual early lifestage survival could be expected to occur in as many as 4 years (6% of the time). Substantial reduction (ranging from about over 10% to over 50%) in annual early lifestage survival of spring-run could occur in 2 years (3% of the time) (Appendix J).

Temperature -Related Impacts in the Lower Sacramento River

Under the 2030 w/ WFP, there would be no substantial change in the 69-year average water temperatures at Freeport (RM 46) for all months of the year (Appendix J). However, substantial temperature increases would occur about 5 to 40% of the time under 2030 w/ WFP, for individual months during the June through September period. Conversely, substantial temperature increases would generally not be expected to occur during the October through May period.

DELTA

Impact **6.5-17**

Delta Fish Populations*. Under the cumulative analysis assumptions, reductions in Delta outflow of more than 10% would occur occasionally during some months of the February through June period considered important for Delta fisheries resources. The analysis also indicates that upstream shifts of the position of X2 of 1 km or more would also occur occasionally during some months. Finally, the analysis indicates that Delta export to inflow ratios under the 2030 w/ WFP would not exceed the maximum export limits for either the February through June (35% of Delta inflow) or the July through January periods (65% of Delta inflow). Although the project would not cause X2 or Delta outflow standards to be violated, the project could result in reductions in outflow and upstream shifts in the position of X2, which could be considered a* ***potentially significant impact*** *to Delta fisheries resources.*

During the yearly period, changes in the 70-year average Delta outflow would range from negligible to reductions of approximately 5% under the 2030 w/ WFP, relative to the Base Condition (Appendix J).

Reductions in Delta outflow of more than 10% under the 2030 w/ WFP, relative to the Base Condition, could occur about 9% to 16% more often in February, March and June. Reductions

in Delta outflow of more than 10% could occur approximately 1% of the time or less in April and May (Appendix J).

Under the 2030 w/ WFP, the greatest upstream shifts in the 70-year average position of X2, relative to its mean monthly position under the Base Condition, would be up to approximately one-half km (Appendix J). During the February through June period considered important for providing appropriate spawning and rearing conditions and downstream transport flows for various fish species, upstream shifts in the position of X2 of more than 1 km would occur 13 to 19% more often in February, March, and June. Upstream shifts in the position of X2 of more than 1 km would occur about 1 to 4% more often in April and May (Appendix J).

Modeling output also showed that the Delta export to inflow ratios under the 2030 w/ WFP would not exceed the maximum export limits for either the February through June (35% of Delta inflow) or the July through January period (65% of Delta inflow) as set by the SWRCB Interim Water Quality Control Plan.

6.6 CUMULATIVE FLOOD CONTROL IMPACTS

The cumulative impacts analysis is based on a set of assumptions about future cumulative conditions throughout the CVP/SWP, including the implementation of the Water Forum Proposal and other reasonably foreseeable future actions. The analysis does not assume any development of additional Sacramento River supplies because no specific proposals are available.

Impact **6.6-1**

Ability to Meet Flood Control Diagrams of CVP/SWP Reservoirs. *Increased diversions from CVP/SWP reservoirs under the future cumulative condition would result in reduced storage during the flood control season, increasing the ability to meet flood control needs. This would be a* ***less-than-significant future cumulative impact.***

For an analysis flood control capability throughout the CVP/SWP at either USBR or DWR controlled reservoirs, it is intuitive that increased diversions from thee reservoirs in the future would have the cumulative effect of resulting in a net beneficial impact to flood control operations system-wide. With increased diversions from these reservoirs, each reservoir would commence the flood control season (November 15) with reduced storage, thereby increasing their ability to meet the early season flood control diagrams. Consequently, throughout the remainder of the flood control season, increased diversions anticipated in the future would also have the effect of reducing reservoir storage, thereby further assisting in the ability to maintain the required empty space storage during these times.

Based on the future cumulative scenario evaluated for 2030, reduced end-of-month reservoir storage in Folsom Reservoir, relative to the Base Condition, would occur in all months of the flood control season. Reductions in storage would range from approximately 16,000 AF to 30,000 AF. For Shasta Reservoir, reductions in end-of-month storage would range from approximately 2,000 AF to 4,000 AF compared to the Base Condition. Such reductions would have an overall effect of enhancing the ability to meet and maintain reservoir operations within

established flood control diagrams during the flood control season and, therefore, result in a net beneficial impact.

6.7 CUMULATIVE POWER SUPPLY IMPACTS

The cumulative impacts analysis is based on on a set of assumptions about future cumulative conditions including implementation of the Water Forum Proposal and other reasonably foreseeable future actions. The analysis does not assume any development of additional Sacramento River supplies because no specific proposals are available. Under this set of assumptions, analysis indicates that impacts to CVP hydropower operations and pumping energy requirements will occur in nearly all years. Impacts to CVP hydropower could result from increased surface water diversions and overall lower reservoir levels across the system. Lower reservoir water surface elevations would result in lower hydraulic head, and consequently lower generation potential at existing power generating plants. At Folsom Reservoir, lower water surface levels could also contribute to increased pumping power requirements for users relying on the Folsom Pumping Plant and the EID Pumping Plant.

CVP hydropower operations under the future cumulative condition are likely to be characterized by reductions to: capacity available for WAPA's preference customers, WAPA surplus capacity sales, and annual average CVP energy production. These cumulative impacts would be considered significant insofar as rates to CVP hydropower customers could increase in response to decreased CVP surplus capacity sales revenues and/or increased WAPA energy and capacity purchases for preference customers.

In the future, reductions in Folsom Reservoir water surface levels could increase pumping requirements at the Folsom and EID pumping plants. Folsom Reservoir storage is expected to be, on average, lower in the future relative to current conditions due, in part, to the increased demands placed on the American River system and increased demands system-wide. This is likely to remain a significant cumulative impact

Impact **6.7-1**

Reduced CVP Hydropower Capacity and Generation. *Under the future (2030) cumulative condition, which includes the WFP and other reasonably foreseeable future system-wide actions (e.g. 2030 out-of-basin CVP/SWP demands, increased Sacramento Valley demands, and increased Trinity River flows), no substantial reduction in average annual surplus capacity or capacity for use by WAPA's preference customers would occur. Under the future cumulative condition, WAPA's capacity peak maximum of 1,152 megawatts would not be met in 47 of the 828 months studied, as compared to 42 months for the Base Condition. However, under the future cumulative condition average annual CVP energy production would be reduced by 225 Gwh compared to the Base Condition. This change in annual average CVP energy production which is roughly equivalent to a 5% reduction, is considered to represent a* **significant impact**.

Changes to hydropower operations caused by future cumulative actions are many and varied. Some changes are directly attributable to observable phenomenon, for example lower reservoir storage directly predicts lower electrical capacity. Other changes are not as clear, for example lower reservoir storage could result in less water spills and more water through the generator

turbines during a year. An examination of the future cumulative results suggests the following. CVP electrical capacity at the generators is lower in most months of most years but not so low as to affect the 1,152 MW in many months. Project use capacity is lower in the future cumulative condition in some years because of less deliveries (increased deficiencies) to CVP contractors. The reduction in Project Use capacity is approximately equal to the overall reduction in CVP capacity at the generators, thus surplus capacity is unchanged between the future cumulative and Base conditions. And, CVP energy production is reduced by virtue of lower reservoir storages diminishing the efficiency (kwh/af) of water released through the powerplants, this, even though Project Use energy requirements are less in the future cumulative condition.

Impact **6.7-2**

Increased Energy Requirements for Diverters Pumping from Folsom Reservoir.
Under the future (2030) cumulative condition, which includes the WFP and other reasonably foreseeable future system-wide actions (e.g. 2030 out-of-basin CVP/SWP demands, increased Sacramento Valley demands, and increased Trinity River flows),would result in changes in pumping requirements for those who pump water from Folsom Reservoir. Under the future cumulative condition, it is anticipated that a 140% increase in average annual pumping energy would be required. While this cumulative impact would be environmentally less-than-significant, it represents an ***economically significant impact****.*

Two factors associated with the future cumulative condition affect the amount of energy required by diverters pumping from Folsom Reservoir. The first of these is the reduction in Folsom water storage attributable to future operations. This reduction in storage decreases the opportunities to deliver water by gravity flow and increases the hydraulic lift required to pump water from the reservoir. A second and more influential effect is that significantly more water will be pumped from Folsom in the future. An estimate of the proportion of increased energy requirements by effect suggests that as much as 115% of the 140% increase is caused by increased diversions and the remaining 25% is caused by other future operational influences which increase the hydraulic lift.

6.8 CUMULATIVE VEGETATION AND WILDLIFE IMPACTS

The cumulative impact analysis is based on a set of assumptions about future cumulative conditions in the year 2030, including implementation of the WFP and other reasonably foreseeable future actions. The analysis does not assume any development of additional Sacramento River supplies because no specific proposals are available. Under this set of assumptions, analysis indicates that significant future impacts to vegetation and wildlife associated with the lower American River would occur, as a result of reduced mean monthly flows. Future flows associated with the Sacramento River and Sacramento-San Joaquin Delta and surface water elevations of affected reservoirs would not be reduced with sufficient magnitude and frequency to adversely affect riparian vegetation and associated special-status species and habitat.

Impact **6.8-1**

Special Status Species, Riparian Vegetation, and Backwater Ponds Associated with the Lower American River. *Under the set of assumptions for future conditions used in the EIR, the cumulative impact analysis indicates that the range of flows within the minimum/optimal range of 1,300 to 4,000 cfs would vary by 3 or fewer years during the 70-year period of record, in comparison to base conditions. As a result, reduced flows under future cumulative conditions would not result in an adverse effect to the special-status species (including the Valley Elderberry Longhorn Beetle) that are dependent on riparian vegetation and backwater ponds associated with Lower American River. This would be a* ***less-than-significant*** *future cumulative impact.*

Under the set of assumptions for future conditions used in the EIR, the cumulative impact analysis indicates that flows in the lower American River would be further reduced. However, during the critical growing season months of April through July, the number of occurrences in which mean monthly flows of the lower American River would be within the minimum/optimal flow range of 1,300 to 4,000 cfs would vary by 3 or fewer years during the 70-year period of record, in comparison to base conditions. As a result, reduced flows under future cumulative conditions would not result in an adverse effect to the special-status species (including the Valley Elderberry Longhorn Beetle) that are dependent on riparian vegetation and backwater ponds associated with Lower American River. This would be a less-than-significant future cumulative impact.

Impact **6.8-2**

Special Status Species and Riparian Vegetation Associated with the Sacramento River and Sacramento-San Joaquin Delta. *Under the set of assumptions for future conditions used in the EIR, the cumulative impact analysis indicates that flows in the lower American River would be further reduced. However, during the critical growing season months of April through July, the number of occurrences in which mean monthly flows of the lower American River would be within the minimum/optimal flow range of 1,300 to 4,000 cfs would vary by 3 or fewer years during the 70-year period of record, in comparison to base conditions. As a result, reduced flows under future cumulative conditions would not result in an adverse effect to the special-status species (including the Valley Elderberry Longhorn Beetle) that are dependent on riparian vegetation and backwater ponds associated with Lower American River. This would be a* ***less-than-significant*** *future cumulative impact.*

Based on the future cumulative scenario evaluated for 2030, additional diversions and potential CVP operations would result in decreases in Sacramento River mean monthly flows. Compared to base conditions, average mean monthly flows of the Sacramento River would be reduced by approximately 3% (320 cfs), during the critical growing season months (April - July). During the remaining months of the growing season (August - October) flows would be reduced, on average, by approximately 2% (170 cfs). As a result, mean monthly flows would not be reduced with sufficient magnitude and frequency to significantly alter existing riparian vegetation dependent on Sacramento River flows and Delta inflows. Because riparian vegetation would not be adversely affected and open water (river) habitat would be available, the special-status species dependent on such habitat would not be adversely affected. This would be a less-than-significant future cumulative impact.

Impact **6.8-3**

Vegetation Associated with Reservoirs. *Under the set of assumptions for future conditions used in the EIR, the cumulative impact analysis indicates that, in comparison to base conditions, mean monthly surface water elevations at Folsom, Shasta, and Trinity reservoirs would be reduced by less than 1% during the months of the growing season (March-October). Because the draw down zones at these reservoirs are vegetated with non-native plants that do not form a contiguous riparian community, minor fluctuations in surface water elevations would not adversely affect important habitat values at these reservoirs. Consequently, this would be a* ***less-than-significant future cumulative impact****.*

Based on the future cumulative scenario evaluated for 2030, additional diversions and potential CVP operations would result in more frequent declines in the water surface elevation of Folsom, Shasta, and Trinity reservoirs. However, during the months of the growing season (March-October) mean monthly surface water elevations at Folsom, Shasta, and Trinity reservoirs would be reduced by less than 1%. Compared to base conditions, future month-end surface water elevations would be reduced by approximately 3 feet at Folsom and Shasta reservoirs and by approximately 6 feet at Trinity Reservoir. Because the draw down zones at these reservoirs are vegetated with non-native plants that do not form a contiguous riparian community, minor fluctuations in surface water elevations would not adversely affect important habitat values at these reservoirs. In addition, Keswick and Whiskeytown Reservoirs would continue to operate as regulating reservoirs for the larger upstream dams, so their pattern of elevation changes would not change under future cumulative conditions. This would be considered a less-than-significant cumulative impact.

6.9 CUMULATIVE RECREATION IMPACTS

The cumulative impact analysis is based on a set of assumptions about future cumulative conditions in the year 2030, including implementation of the WFP and other reasonably foreseeable future actions. The analysis does not assume any development of additional Sacramento River supplies because no specific proposals are available. Under this set of assumptions, analysis indicates that significant cumulative impacts to future recreation opportunities associated with the lower American River and Folsom Reservoir would occur. Future flows associated with the Sacramento River and Sacramento-San Joaquin Delta and surface water elevations of the other affected reservoirs would not be reduced with sufficient magnitude and frequency to result in significant cumulative impacts to recreational opportunities.

Impact **6.9-1**

Cumulative Impacts on the Lower American River Recreation Opportunities. *Under the set of assumptions for future conditions used in the EIR, the cumulative impact analysis indicates that flows in the lower American River would be even further reduced. For example, during the months of May through September, the number of occurrences in which mean monthly flows of the lower American River would be reduced below the minimum threshold of 1,750 cfs would increase by as much as 40%, in comparison to base conditions. The WFP would contribute to this cumulative impact. This would be a* ***significant future cumulative impact****.*

Based on the future cumulative scenario evaluated for 2030, additional diversions and potential CVP operations would result in substantial decreases in Lower American River mean monthly flows during the high recreation use season. Compared to the Base Conditions, mean monthly flows during the period of May through September would be approximately 10% lower under the future cumulative condition. Mean monthly flows would fall below the 1,750 cfs minimum flow for rafting and boating in approximately 20 to 40% more years during most months of the summer recreation season. The greater frequency of inadequate flows for rafting and boating would substantially diminish recreation opportunities on the Lower American River and would be considered a significant cumulative impact.

Impact **6.9-2**

Cumulative Impacts to Folsom Reservoir Recreation Opportunities. *Under the set of assumptions for future conditions used in the EIR, the cumulative impact analysis indicates that, in comparison to base conditions, surface water elevations at Folsom Reservoir would be further reduced. For example, during the recreational use period of the year (primarily May-September), the number of occurrences in which lake levels would decline below the minimum 412-foot elevation for use of marina wet slips would increase by more than 10%, in comparison to base conditions. Reduced lake levels under the cumulative condition would also adversely affect swimming beaches. The WFP would contribute to this cumulative condition and it would be a* ***significant future cumulative impact****.*

Based on the future cumulative scenario evaluated for 2030, additional diversions and potential CVP operations would result in more frequent declines in the water surface elevation of Folsom Reservoir during the high recreation use season. Compared to the Base Conditions, month-end elevations would typically average about 3 feet lower during the May through September period under the future cumulative condition. Month-end elevations would fall below the 420-foot elevation necessary to maintain all boat ramps in operation and keep swimming beaches useable slightly more often than Base Conditions early in the season and in approximately 20% more years than under Base Conditions in the later months of the season. Also, month-end elevations would decline below the 412-foot level necessary to keep wet slips in operation in approximately 10 to 25% more years, depending on the month of the season. The greater frequency of water surface elevation declines would substantially diminish recreation opportunities on the Folsom Reservoir and would be considered a significant cumulative impact.

Impact **6.9-3**

Sacramento River and Sacramento-San Joaquin Delta Recreation Opportunities Under Future Cumulative Conditions. *Under the set of assumptions for future conditions used in the EIR, the cumulative impact analysis indicates that during the critical growing season months of April through July mean monthly flows in the Sacramento River would be reduced by approximately 3%, in comparison to base conditions. Flows would not be reduced with sufficient magnitude and frequency to adversely affect recreational opportunities associated with the Sacramento River and Sacramento-San Joaquin Delta. This would be a* ***less-than-significant future cumulative impact****.*

Based on the future cumulative scenario evaluated for 2030, additional diversions and potential CVP operations would result in small decreases in Sacramento River mean monthly flows during the high recreation use season. Compared to the Base Conditions, mean monthly flows during the period of May through September would be approximately 3% lower under the future

cumulative condition. The summer flows in the Sacramento River remain sufficient to support water-dependent and water-enhanced recreation activity. On the upper Sacramento River, mean monthly flows below Keswick Reservoir during the May to September recreation season range between approximately 6,500 cfs to over 12,000 cfs. On the lower Sacramento River, mean monthly flows at Freeport during the May to September recreation season range between approximately 14,000 cfs to over 18,000 cfs. The change in frequency of reduced flows for rafting and boating would not be sufficient to substantially diminish recreation opportunities on the upper and lower Sacramento River and would be considered a less-than-significant cumulative impact.

Impact **6.9-4**

Lake Natoma, Whiskeytown, Keswick, Shasta, and Trinity Reservoirs Recreation Opportunities Under Future Cumulative Conditions. *Under the set of assumptions for future conditions used in the EIR, the cumulative impact analysis indicates that, in comparison to base conditions, mean monthly surface water elevations at Shasta and Trinity reservoirs would be reduced by less than 1% during the recreational use period of the year (primarily May-September), which would not substantially diminish recreation opportunities. Because Lake Natoma, Whiskeytown, and Keswick reservoirs serve as regulating reservoirs, the pattern of surface water elevations changes at these reservoirs is not expected to change substantially under cumulative conditions. This would be a* ***less-than-significant future cumulative impact.***

Based on the future cumulative scenario evaluated for 2030, additional diversions and potential CVP operations would result in slightly greater declines in the water surface elevation of Shasta and Trinity Reservoirs during the high recreation use season. Compared to the Base Conditions, month-end elevations would typically decrease by less than one-half of 1% during the May through September period under the future cumulative condition. Month-end elevations would fall below the 941-foot elevation necessary to maintain at least one boat ramp in operation in each major arm of Shasta Reservoir typically only one year more often under future cumulative conditions compared to Base Conditions. Keswick and Whiskeytown Reservoirs would continue to operate as regulating reservoirs for the larger upstream dams, so their pattern of elevation changes would not change under future cumulative conditions. The change in frequency of water surface elevations would not be substantial and would not substantially diminish recreation opportunities on the Shasta, Trinity, Keswick, and Whiskeytown Reservoirs; this would be considered a less-than-significant cumulative impact.

6.10 CUMULATIVE LAND USE AND GROWTH-INDUCING IMPACTS

One of the coequal objectives of the WFP is "to provide a reliable and safe water supply for the region's economic health and planned development through the year 2030." Under the WFP, water would be provided to purveyors which serve jurisdictions in the water service study area. With sufficient water, jurisdictions can make decisions about how much and what type of development to approve, in accordance with planned land uses, recognizing that water supply is not a constraint.

Land use designations established in the most recent general plans for the jurisdictions in the water service study area represent the maximum long-term level of growth approved by city and

county decision-makers. Because the WFP addresses the region's water demands through the year 2030, and the buildout years of the general plans are not able to be precisely predicted, the reliable water supply provided by the WFP to each purveyor may fall short of, just meet, or exceed water demand at buildout. The diversions provided for in the WFP are intended to accommodate each agency's projected surface water need in 2030 considering such factors as projected growth rate, water rights, conservation levels, availability of alternative water supplies, environmental considerations, and other factors. Section 4.10, Land Use and Growth-Inducing Impacts, of this EIR evaluates the WFP's potential land use effects in relation to the adopted general plans for long-term growth of the communities in the water service study area. As such, that analysis is inherently cumulative, and the reader is referred to Section 4.10 for an analysis of cumulative land use and growth-inducing impacts.

6.11 CUMULATIVE AESTHETICS IMPACTS

The cumulative impact analysis is based on a set of assumptions about future cumulative conditions in the year 2030, including implementation of the WFP and other reasonably foreseeable future actions. The analysis does not assume any development of additional Sacramento River supplies because no specific proposals are available.

Discernible aesthetic impacts along river corridors are primarily associated with adverse impacts to localized vegetation. As previously discussed, significant reductions in river flow can result in a reduced expanse of the water area, which can result in the thinning of the riparian corridor, loss of valuable border zone vegetation, and subsequent degradation of wildlife habitat. Under the set of assumptions used in this EIR, analysis indicates that future impacts to the aesthetic quality could occur, as a result of adverse impacts to riparian vegetation and wildlife habitat associated with the lower American River. Flows would not be reduced with sufficient magnitude and frequency to significantly alter existing riparian vegetation and habitat dependent on Sacramento River flows and Delta inflows. As a result, the aesthetic quality of the Sacramento River and Sacramento-San Joaquin Delta would not be adversely affected.

Discernible aesthetic impacts among reservoirs are generally assumed to occur with reductions in surface water elevations of greater than 10 feet. As a result, significant aesthetic effects of reservoirs would be based primarily on the frequency in which future surface water elevations would be reduced by more than 10 feet, in comparison to base conditions. Under the set of assumptions used in this EIR, analysis of future cumulative conditions indicates that impacts to the aesthetic quality of reservoirs would not occur.

Impact **6.11-1**

Aesthetic Value of the Lower American River. *Under the set of assumptions for future conditions used in the EIR, the cumulative impact analysis indicates that flows in the lower American River would be further reduced. However, during the critical growing season months of April through July, the number of occurrences in which mean monthly flows of the lower American River would be within the minimum/optimal flow range of 1,300 to 4,000 cfs would vary by 3 or fewer years during the 70-year period of record, in comparison to base conditions. As a result, reduced flows under future cumulative conditions would not result in an adverse effect to riparian vegetation and habitat and, as such, would not result in an adverse affect to*

the aesthetic quality of the lower American River. This would be a ***less-than-significant future cumulative impact.***

Based on the future cumulative scenario evaluated for 2030, additional diversions and potential CVP operations would result in decreases in Lower American River mean monthly flows. Compared to base conditions, the number of occurrences in which mean monthly flows of the Lower American River would be reduced below the minimum threshold necessary for the maintenance of riparian vegetation (1,765 cfs) would increase by approximately 20% or more, during the critical growing season months (April - July). In addition, the number of occurrences in which future mean monthly flows would be reduced below the minimum threshold necessary for backwater pond recharge (1,300 cfs) would increase by more than 30%. Reduced flows under future cumulative conditions could result in an adverse effect to riparian vegetation and backwater ponds within the Lower American River corridor. Because discernible aesthetic impacts along river corridors are primarily associated with adverse impacts to localized vegetation, the aesthetic quality of the Lower American River, under future cumulative conditions, could be adversely affected. Because the WFP would contribute to this cumulative impact, this would be a **significant** future cumulative impact.

Impact **6.11-2**

Aesthetic Value of the Sacramento River and Sacramento-San Joaquin Delta. *Under the set of assumptions for future conditions used in the EIR, the cumulative impact analysis indicates that mean monthly flows in the Sacramento River would be reduced by approximately 3%, in comparison to base conditions, during the critical growing season months of April through July. Flows would not be reduced with sufficient magnitude and frequency to significantly alter existing riparian vegetation dependent on Sacramento River flows and Delta inflows. As a result, the aesthetic quality of the Sacramento River and Sacramento-San Joaquin Delta would not be adversely affected. This would be a* ***less-than-significant future cumulative impact****.*

Based on the future cumulative scenario evaluated for 2030, additional diversions and potential CVP operations would result in decreases in Sacramento River mean monthly flows. Compared to base conditions, average mean monthly flows of the Sacramento River would be reduced by approximately 3% (320 cfs), during the critical growing season months (April - July). During the remaining months of the growing season (August - October) flows would be reduced, on average, by approximately 2% (170 cfs). As a result, mean monthly flows would not be reduced with sufficient magnitude and frequency to significantly alter existing riparian vegetation dependent on Sacramento River flows and the Sacramento San Joaquin Delta inflows. As a result, the aesthetic quality of the Sacramento River and Sacramento-San Joaquin Delta, under future cumulative conditions, would not be adversely affected. This would be a less-than-significant future cumulative impact.

Impact **6.11-3**

Aesthetic Value of Reservoirs. *Under the set of assumptions for future conditions used in the EIR, the cumulative impact analysis indicates that mean monthly surface water elevations at Folsom, Shasta, and Trinity reservoirs would be reduced by less than 5 feet, in comparison to base conditions. In addition, because Lake Natoma, Whiskeytown, and Keswick Reservoir serve as regulating reservoirs, future surface water elevations at these reservoirs are not expected to change substantially. Consequently, this would be a* ***less-than-significant future cumulative impact.***

Based on the future cumulative scenario evaluated for 2030, additional diversions and potential CVP operations would result in more frequent declines in the water surface elevation of Folsom, Shasta, and Trinity reservoirs. However, compared to base conditions, future mean monthly surface water elevations at Folsom, Shasta, and Trinity reservoirs would be reduced by less than 1%. Based on the 70-year hydrologic period of record, month-end surface water elevations would be reduced, on average, by approximately 4 feet or less at Folsom and Shasta reservoirs and approximately 8 feet or less at Trinity Reservoir. In addition, Keswick and Whiskeytown Reservoirs would continue to operate as regulating reservoirs for the larger upstream dams, so their pattern of elevation changes would not change under future cumulative conditions. This would be considered a less-than-significant cumulative impact.

6.12. CUMULATIVE CULTURAL RESOURCES IMPACTS

Under the future (2030) cumulative condition, which includes the WFP and other reasonably foreseeable future system-wide actions (e.g., out-of-basin CVP/SWP demands, increased Sacramento Valley demands, and increased Trinity River flows), changes (e.g., lowered reservoir storage and river flows) in the hydrology of CVP/SWP waterbodies and watercourses are expected. Such changes have the potential to affect known and unknown cultural resource sites within Folsom Reservoir, the Lower American River, and the Lower Sacramento River through any combination of increased exposure, inundation, or physical deterioration caused by increased wave action.

This section provides a discussion of the potential impacts to cultural resources that could occur in Folsom Reservoir, the Lower American River, and the Lower Sacramento River under the future cumulative condition, relative to existing conditions.

Impact **6.12-1**

Physical Deterioration of Cultural Resource Sites in Folsom Reservoir. *Under the future (2030) cumulative condition, which includes the WFP and other reasonably foreseeable future system-wide actions (e.g., 2030 out-of-basin CVP/SWP demands, increased Sacramento Valley demands, and increased Trinity River flows), Folsom Reservoir water surface elevations would be reduced more frequently and/or by greater magnitudes compared to that occurring solely as a result of the WFP. Future reductions in 70-year monthly average water surface elevation would approximate 2 to 4 ft, relative to existing elevations. Such reductions would result in a lowered zone where water-level fluctuations would be the most pronounced. The effect of this lowered fluctuation zone on cultural resources would be to expose sites that historically had experienced a higher degree of protection from erosion and other physical destructive forces. Under the future cumulative condition, this would be a* ***potentially significant cumulative impact****.*

It is expected that increased diversions system-wide would occur in the future. These increased diversions, both out-of-basin and those within and outside of the WFP in the American River watershed, would have the overall system-wide effect of lowered storage and water surface elevations in Folsom Reservoir. Such reductions would lower the zone where water-level fluctuations would be the most pronounced, and also increase the number of fluctuations in this zone each year. The long-term effect on cultural resources would be to expose sites that

historically have been somewhat protected from erosion and hydrologic sorting through wave action, to increased vandalism, and to more rapid breakdown of organic remains through repeated wetting and drying.

Impact **6.12-2**

Inundation or Exposure of Cultural Resource Sites in the Lower American River.
Under the future (2030) cumulative condition, which includes the WFP and other reasonably foreseeable future system-wide actions (e.g., 2030 out-of-basin CVP/SWP demands, increased Sacramento Valley demands, and increased Trinity River flows), river flows in the Lower American River would be reduced more frequently and/or by greater magnitudes compared to that occurring solely as a result of the WFP. With overall reductions in 70-year monthly average river flows (up to 11% , but generally about 5%), the potential for inundation of cultural resource sites along the Lower American River would be less than that existing today. Such reductions, however, would also not exceed those historically recorded, thereby avoiding further exposure of any cultural remains which are presently submerged. This would represent a ***less-than-significant cumulative impact****.*

It is expected that future mean monthly river flows in the lower American River below Nimbus Dam would be lower than at present, implying that no new areas (or cultural resources) would be inundated. Overall reduction in 70-year monthly average river flows could approximate 10% but, would generally be much lower. Additionally, minimum mean monthly flows would be higher, suggesting that any cultural remains which presently are submerged (e.g., old shipwrecks) would continue to be submerged. It is expected that future changes in river flows along the lower American River between Nimbus Dam and the river mouth would have a less-than-significant cumulative effect on cultural resources.

Impact **6.12-3**

Inundation or Exposure of Cultural Resource Sites in the Lower Sacramento River.
Under the future (2030) cumulative condition, which includes the WFP and other reasonably foreseeable future system-wide actions (e.g., 2030 out-of-basin CVP/SWP demands, increased Sacramento Valley demands, and increased Trinity River flows), flows in the Lower Sacramento River would be reduced more frequently and/or by greater magnitudes compared to that occurring solely as a result of the WFP. Such reductions on a 70-year monthly average, however, are anticipated to be generally less than 4% , relative to existing flow conditions. These reductions would be small enough that exposure of submerged cultural resources would be highly unlikely. Moreover, any cultural resources within the river banks and floodplain would not be affected since flows would, on average, be lower and it is assumed that the existing levee system would continue to provide channelized protection of the floodplain areas. This would be considered to represent a ***less-than-significant cumulative impact****.*

It is expected that future increased water demands would result in decreased flows on the lower Sacramento River for most of the year, with somewhat higher minimum mean monthly flows during the winter and early spring (February-April). It is conceivable that decreased flows could expose submerged cultural resources (e.g., shipwrecks), however, the decrease would be small enough (i.e., generally less than 4%, relative to existing flow conditions) that such exposure would be highly unlikely. Cultural resources along the river banks and within the floodplain would not be affected since on average, flows would be lower and, it is assumed that the existing levee system would continue to act to contain river flows within the channelized portion of the

river. It is expected that future changes in river flows along the lower Sacramento River near Freeport would have a less-than-significant cumulative impact on cultural resources.

6.13 CUMULATIVE SOILS AND GEOLOGY IMPACTS

Under the future (2030) cumulative condition, which includes the WFP and other reasonably foreseeable future system-wide actions, increasing land development is anticipated to occur throughout Sacramento, Placer, El Dorado, and San Joaquin counties. This section provides a discussion of the potential cumulative impacts to soils and geology throughout this region, relative to existing conditions.

Impact **6.13-1**

Changes in Geologic Substructures. *In the future, it is anticipated that development will continue throughout the region. Associated with this anticipated development, ground disturbing activities of new construction efforts have potential to substantially change geologic substructures. With major construction projects, potential changes to subsurface geology could affect human safety. However, development and planning of future projects would consider geotechnical studies and implement design recommendations, as appropriate, in order to minimize any hazardous geologic changes to the underlying substrata. Therefore, cumulative changes in geologic substructures are considered* ***less than significant.***

In the future, construction activities associated with development and major capital improvement projects requiring earth moving, ground breaking or disturbance of the existing subsurface geologic environment will inevitably occur. However, specific projects would conform to their site plans and, as construction activities become known and developed, detailed site-specific analyses of those physical structures on the underlying geologic substrata would be made. Future cumulative impacts to geologic substructures would represent a less-than-significant impact.

Impact **6.13-2**

Exposure to Major Geologic Hazards. *In the future, it is recognized that major capital improvement and construction projects will occur with the potential to expose people or property to major geologic hazards. Given the relative stability of the geologic subsurface environment in the greater Sacramento area, exposure to geologic hazards is considered to be a* ***less-than-significant impact****.*

In the future, development activities are not expected to expose people or property to unnecessary hazards associated with ground shaking induced by earthquakes and the threat of major structural failures (i.e., building collapse). Future projects, when proposed, would be required to fully consider and evaluate specific information relating to the site plans and construction activities associated with those projects. Moreover, slope instability would be a potential concern only highly localized areas. Future exposure to major geologic hazards is considered to represent a less-than-significant cumulative impact.

Impact **6.13-3**

Increased Soil Erosion by Wind or Water. *Future development activities could disturb surface soils and thereby induce either wind or water erosion. This, however, would be highly localized and temporary, potentially occurring only during construction periods. Future compliance and adherence to project-specific siting investigations, soils/geotechnical studies and the implementation of any necessary project-specific mitigation measures, would avoid long-term soil erosion. This is considered to represent a* ***less-than-significant impact****.*

Future development and its associated ground disturbing activities have the potential to induce soil erosion through wind or water transport. Prior to the approval and implementation of future project-specific actions or their components, siting/location investigations as well as soils/geotechnical studies would be conducted as part of the required design and environmental analysis for those individual proposed projects. Significant efforts are in place to avoid soil erosion through local ordinances and mitigation measures developed for individual projects. In the future, increased soil erosion or substantial permanent soil cover loss are considered to represent less-than-significant impacts.

Impact **6.13-4**

Loss of Soil Cover. *In the future, increasing development across the region will undoubtedly result in a loss of soil cover. Certain projects, depending on their scale and location, may result in permanent loss of some soil cover. Protection against loss of valuable soils (for farmland purposes) is provided through the State mapping and identification system and avoided and/or mitigated through CEQA mitigation of project-specific actions. Future soil loss represents a* ***less-than-significant impact.***

In the future, loss of soil cover resulting from land conversions (e.g., agricultural to urban) is expected to continue. While mechanisms at the local level are in place to assist in the overall preservation of these lands (e.g., Sacramento County General Plan Policy CO-55), and State inventory systems (i.e., FMPP) provide useful information to identify soils considered valuable for productive purposes, some soil loss through future land conversion will occur. Through existing policies and mitigative requirements applied through the CEQA process, it is anticipated that future soil loss, while inevitable, will not result in a significant cumulative impact.

6.14 MITIGATION MEASURES FOR CUMULATIVE IMPACTS AND LEVEL OF SIGNIFICANCE AFTER MITIGATION

CUMULATIVE IMPACT MITIGATION MEASURES

The WFP includes many provisions to reduce impacts, including cumulative impacts on the CVP system, Sacramento River, and Bay-Delta (refer to Section 4.1.5 of the EIR). In addition, mitigation measures are identified to address significant project impacts, as warranted, in Section 4.2 through 4.13 of the EIR for each environmental topic area (also refer to the Executive Summary, Table 2-2).

The State CEQA Guidelines indicate that the focus of an EIR's discussion of mitigation for cumulative effects is on the measures necessary to mitigate or avoid the project's contribution to a cumulative impact. Section 15130(b)(3) of the Guidelines indicates that "[a]n EIR shall

examine reasonable, feasible options for mitigating or avoiding the project's contribution to any significant cumulative effects." The identified mitigation measures for project impacts would also serve to lessen or mitigate for the WFP's contribution to the effects of the future cumulative scenario modeled for this EIR. Therefore, the EIR also recognizes them as mitigation for cumulative impacts (refer to the Executive Summary, Table 2-3).

Even with the provisions in the WFP and the project mitigation measures identified in the EIR, unless additional water supplies are developed, or diversions are reduced, there would still be remaining cumulative impacts on the CVP system, Sacramento River, and the Bay-Delta.

Many of the actions necessary to mitigate or avoid the remaining cumulative impacts are the responsibility of USBR and other federal and state agencies with jurisdiction over the affected resources, such as CALFED, USFWS, NMFS, and CDFG. The number and range of potential policy decisions and actions, or combination thereof, are considerable, and it is not feasible to predict which measures can and should be implemented by the involved federal and state agencies. Decision-making about systemwide, water resource management policies, programs, and mitigation actions is ongoing through the CALFED process, USBR implementation of the CVPIA, consultation with USFWS and NMFS in compliance with the Endangered Species Act, and other efforts. These decisions are influenced by statewide interests and state and federal mandates that are beyond the control of the Water Forum participants. Therefore, attempting to define other potential cumulative impact mitigation measures in this EIR, beyond those already included in the WFP or identified in the EIR for the project impacts, would be too speculative at this time.

LEVEL OF SIGNIFICANCE OF CUMULATIVE IMPACTS AFTER MITIGATION

The ability to entirely avoid or mitigate cumulative impacts to a less-than-significant level depends on numerous state and federal policy decisions and actions beyond the control of the Water Forum participants. If additional water supplies are developed, or diversions are reduced, it is conceivable that cumulative impacts could be mitigated by policy decisions and actions by the relevant state and federal agencies. However, it is not yet feasible to reliably predict the outcome of the various state and federal water resource management programs.

Although the provisions of the WFP and identified mitigation measures for project impacts would also help reduce cumulative impacts, it cannot be assured at this time that the significant cumulative impacts described in this EIR would be avoided or reduced to a less-than-significant level. Because of the uncertainty, it is necessary for CEQA compliance purposes to recognize and disclose that the cumulative impacts identified in this EIR could be significant and unavoidable. Consequently, any significant cumulative impacts described in Sections 6.2 through 6.13 of this EIR are considered to be potentially significant and unavoidable (also refer to the Executive Summary, Table 2-3).

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