FOLSOM DAM MODIFICATION PROJECT
WATER CONTROL MANUAL UPDATE

FINAL
SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT/
ENVIRONMENTAL IMPACT REPORT

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US Army Corps of Engineers

CENTRAL VALLEY FLOOD PROTECTION BOARD
PUBLIC SAFETY AND FLOOD MANAGEMENT
STATE OF CALIFORNIA

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

SAFCA
Sacramento Area Flood Control Agency

EXECUTIVE SUMMARY

ES.1. BACKGROUND, PURPOSE, AND NEED FOR ACTION

Since the flood of record in 1986 and a subsequent event in 1997, the U.S. Army Corps of Engineers (USACE), Sacramento District, in cooperation with the U.S. Bureau of Reclamation (Reclamation), the State of California Central Valley Flood Protection Board (CVFPB) and Department of Water Resources (DWR), and the Sacramento Area Flood Control Agency (SAFCA), has been evaluating opportunities to reduce the level of flood risk to the Sacramento Metropolitan Area. Potential opportunities have included improving flood conveyance along the lower American and Sacramento Rivers, as well as modifying features and operations of the Folsom Dam and Reservoir to increase dam safety and more effectively manage flood risk both above and below the dam.

The effects of the 1986 and 1997 storms raised concerns over the adequacy of the existing flood risk management system, which led to a series of investigations on the need to provide additional protection to Sacramento. The results of these investigations led to authorization of several flood risk management projects in and near the American River Watershed, including the Folsom Dam Modifications project (features now included in the Folsom Dam Safety / Flood Damage Reduction Project, also known as the Joint Federal Project [JFP])), the Folsom Dam Raise, the American River Common Features flood damage reduction project and general reevaluation, and the West Sacramento flood damage reduction project and general reevaluation. Changes in flood operations at Folsom Dam are needed to fully realize the flood risk management benefits anticipated from each of these projects.

Construction of the ongoing JFP was completed in 2017. Per Section 101(e) of the Water Resources Development Act (WRDA) of 1999, USACE was directed by Congress to update the water control manual (WCM) for Folsom Dam to fully realize the flood risk management and dam safety benefits of the completed Folsom Dam Modifications (now JFP). Sections 101(b) and 101(e) of the Act also directed USACE to reduce variable space allocation from the current interim operating range between 400,000 acre-feet (af) and 670,000 af to a range between 400,000 af and 600,000 af, and to evaluate the feasibility of incorporating improved weather forecasts from the National Weather Service (NWS) into an updated WCM for Folsom Dam and Lake (Manual Update).

The purpose of the JFP is to (1) reduce flood risk in the Sacramento Metropolitan Area in conjunction with other features of the regional flood risk management system, and (2) pass the Probable Maximum Flood (PMF) while maintaining at least 3 feet of freeboard to the top of dam for dam safety purposes. The JFP is designed to improve the ability of Folsom Dam to manage large flood events by allowing more water to be safely released earlier in a storm event, resulting in more storage capacity remaining in the reservoir to hold back the peak inflow. This is accomplished through construction and operation of the new gated auxiliary spillway, with a spillway crest elevation 50 feet lower in elevation than the current gated spillways at Folsom Dam. The purpose of the Manual Update is to establish new operational changes to fully realize the flood risk management and dam safety benefits of the new auxiliary spillway in coordination with Reclamation, CVFPB, the California Department of Water Resources (DWR), and SAFCA. The new set of reservoir operation rules were developed to meet, at a minimum, the following five primary dam safety and flood risk management objectives:

- Pass the PMF while maintaining at least 3 feet of freeboard below the top of dam to stay within the dam safety constraints of Reclamation.
- Control a 1/100 annual chance event ("100-year flood") to the normal objective release of 115,000 cfs as criteria set by SAFCA to support FEMA levee accreditation along the American River.
- Control a 1/200 annual chance event ("200-year flood") as defined by criteria set by DWR to a maximum release of 160,000 cfs.
- Reduce the variable space allocation from the current operating range of 400,000-670,000 af to 400,000-600,000 af as directed in WRDA 1999 authorizing language.
- Incorporate improved forecasting capabilities from the NWS.

To the extent possible, the Manual Update will conform with the other authorized purposes and operational criteria for Folsom Dam and Reservoir, including water supply, water quality, fish and wildlife preservation, hydropower, and recreation. The Manual Update will also consider the effects of the update on the overall water system, including the Central Valley Project (CVP) and State Water Project (SWP).

ES.2. PURPOSE OF SEA/EIR

This SEA/EIR (1) describes the development and features of alternatives; (2) discusses environmental resources in the local project area and regional effects assessment areas; (3) evaluates the direct, indirect, and cumulative effects and significance of the alternatives on these resources; and (4) proposes best management practices and mitigation measures to avoid or reduce any effects to less than significant, where feasible.

This SEA/EIR has been organized in accordance with NEPA and CEQA content requirements for each type of environmental document, as well as by USACE policies and editorial styles. Sections have also been added related to development of the alternatives.

This report is organized into 9 chapters. Chapter 2 summarizes the development of the alternatives, while Chapter 3 describes the alternatives in detail including detailed descriptions of new operational rules for alternative plans including the proposed action. Chapter 4 discusses the resources in the project areas, evaluates the potential effects of the alternatives on those resources, and proposes measures to avoid, minimize, or mitigate/compensate those effects, if possible. Chapter 5 then discusses the other required disclosures, including growth-inducing effects, while Chapter 6 summarizes the project's compliance with Federal, State, and local environmental laws and Executive Orders. Chapter 7 discusses the public involvement efforts from scoping through notices of availability of the final document. Chapters 8 and 9 identify the preparers and references, respectively.

Following completion of the NEPA and CEQA processes, including signatures on the Finding of No Significant Impact (FONSI) and Notice of Determination (NOD), the updated WCM and

Water Control Plan would be approved for implementation by the USACE Commander, South Pacific Division, and Reclamation's Director of the Mid-Pacific Region.

ES.3. PROJECT AREAS

Local Project Area

The local project area for the Manual Update is located in the lower American River Watershed in Placer, El Dorado, and Sacramento Counties (Figure ES-1). The Manual Update project area includes Folsom Dam and Reservoir, Nimbus Dam, Lake Natoma, and the lower American River to its confluence with the Sacramento River approximately 30 miles downstream from Folsom Dam. The Folsom Dam and Reservoir, a multipurpose water project, was completed by USACE in 1956 and is currently operated by Reclamation as part of the CVP.

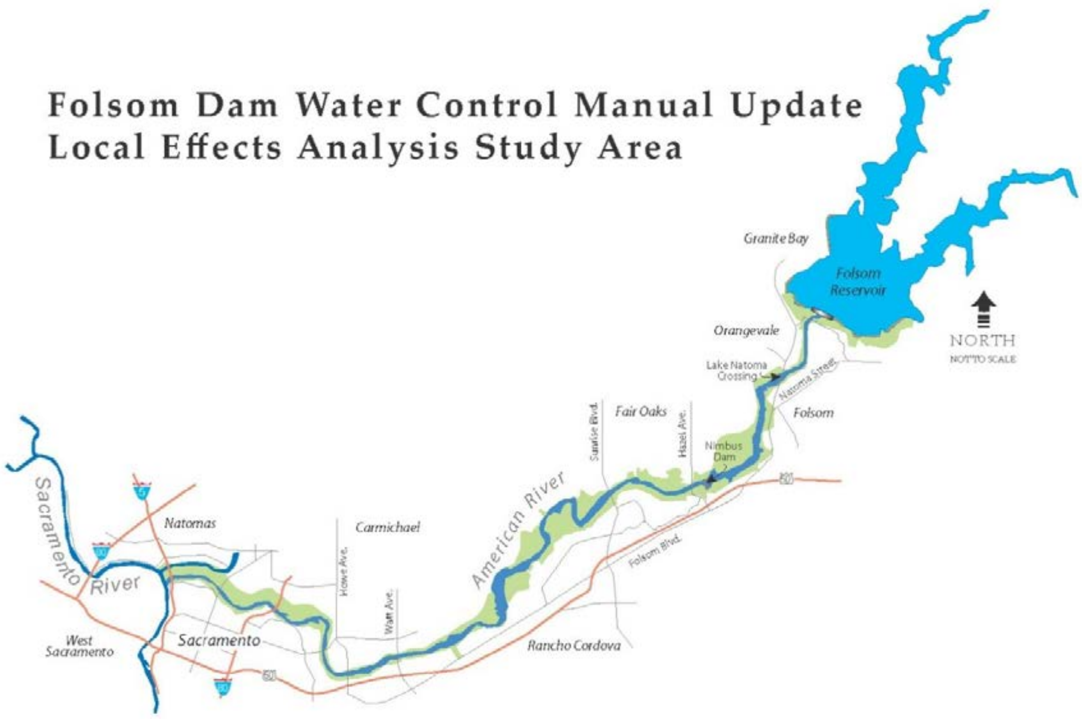

Figure ES-1. American River Local Project Area.

There will be no action taken in the American River Basin upstream of Folsom Lake. Although information on the current upstream basin hydrologic condition and forecast information developed from existing gage data and other meteorological data is retrieved from the California Data Exchange Center and NWS to inform current operational decisions, no changes to existing operations of upstream reservoirs is proposed as part of this study.

Regional Effects Assessment Area

The regional effects assessment area for the Manual Update is located primarily in the Central Valley and Sacramento-San Joaquin Delta (Delta) areas in California. The regional area includes the facilities and service areas of the CVP and SWP. Water is provided in accordance with contracts and legal requirements for hydropower, agriculture, Municipal and Industrial (M&I) supply, and fish and wildlife.

The CVP's major storage facilities are Shasta and Folsom on the Sacramento and American Rivers, respectively. Water from these reservoirs is conveyed by the Sacramento River into the Delta. Water is then pumped from the Delta via the Jones Pumping Plant and conveyed south via canals and tunnels for storage and delivery to the CVP, the exchange, and water rights contractors. One of the larger facilities, Folsom Reservoir makes up approximately 10 percent of the total CVP storage (Reclamation 2005).

The SWP's primary storage facility is Lake Oroville on the Feather River, a tributary of the Sacramento River. The SWP water flows in the Sacramento River to the Delta and is pumped via the Harvey O. Banks Pumping Plant into the California Aqueduct, which delivers water to San Luis Reservoir and SWP contractors in the southern San Joaquin Valley, Central Coast area, and southern California. The CVP and SWP coordinate their operations to divert, store, convey, and distribute project water to users and purveyors.

A full description of the regional effects assessment area is found in Section 1.6 of the 2016 Coordinated Long Term Operation of the Central Valley Project and State Water Project EIS (USBR 2016).

ES.4. ALTERNATIVES

After the goals and objectives were determined, USACE identified the 82-year period of record hydrology for the American River Basin and developed a set of synthetic inflow hydrologies for hypothetical storm events including the 1/100 and 1/200 annual chance flows and the PMF for Folsom Dam. Candidate flood operations were developed to govern use of the increased release capacity provided by the new JFP auxiliary spillway and 400,000 to 600,000 af variable flood storage. These storage operations included: 1) maintain the existing interim WCD with upstream credit storage operation restricted to 600,000 af (600 TAF) flood space at Folsom; 2) updated WCD with early spring refill and combined crediting of upstream storage and basin wetness; and 3) updated WCD with forecast-based top of conservation (TOC).

These operation rules and hydrologic data were input into HEC-ResSim, a reservoir system simulation program designed by USACE to model operations at one or more reservoirs whose operations are defined by a variety of operational goals and constraints (HEC, 2012). Details of the upstream reservoir considerations in the model can be found in USACE Engineering Report for the Manual Update. The model represents the operating goals and constraints with an original system of rule-based logic that has been specifically developed to represent the decision-making process of reservoir operation.

Running the HEC-ResSim model produced a set of releases and storage volumes for Folsom Dam and Lake for each hypothetical storm event. USACE then evaluated whether each flood operation rule developed met the flood risk management objectives identified in Section 1.3.1. If a set of flood operation rules met the objectives, then that set was considered further. If not, then the set of rules was refined and the model rerun until the primary objectives were met. This iterative process was repeated until a range of "viable" operation rule sets for Folsom Dam were identified.

The Folsom Dam flood operation rules for those initial rule sets meeting the primary flood risk management objectives were then input into the CalSim II system model. Developed by Reclamation and DWR, this planning model simulates the statutory, legislative, and regulatory constraints in operating the CVP/SWP. Since use of the model is widely accepted by water purveyors, water rights owners, and contract holders, CalSim II is the system model that is used for most interregional and statewide analyses of CVP/SWP water allocations in California. This model was used to evaluate the effects of alternatives on the beneficial uses of water supply provided by Folsom Dam and Reservoir.

Following the refinement of initial alternatives, there were two action alternatives carried forward for further consideration:

- Alternative 1 – Basin Wetness Parameters with Variable Folsom Flood Control Space (400,000 af to 600,000 af): uses information about creditable upstream space and basin wetness, provided by the National Weather Service's California-Nevada River Forecast Center (CNRFC), to compute the required flood control space at Folsom. The credit from each source is computed, summed, and then added to the minimum TOC storage value for that day. The TOC value is the lowest water surface elevation needed for flood storage in the lake for that day. The adopted TOC value is the lesser of the computed and maximum TOC storage values.
- Alternative 2 – Forecast Informed Operations with Variable Folsom Flood Control Space (400,000 af to 600,000 af): the forecast-informed operations alternative is described in detail in Section 3.1.2.

Each action alternative incorporates both the additional release capacity provided by the JFP spillway and variable winter flood space of 400,000 to 600,000 af. The basin wetness alternative (Alternative 1) and the forecast informed alternative (Alternative 2) also incorporated an earlier spring-refill curve, intended to allow earlier storing of additional water during wet years for use in the spring and summer. The revised diagram was tested, using scaled seasonal events and seasonal PMFs, to ensure flood protection and dam safety goals are met.

A potential incidental benefit of Alternative 2-forecast informed operations to non-flood operations is that the TOC is effectively allowed to be at the highest level permitted by the WCD, except immediately preceding and during an event (see Figure ES-2). Unlike Alternative 1 that relies on upstream storage credit and/or basin wetness, the TOC returns to the highest allowed level once an event has passed, providing improved opportunity for the reservoir to refill.

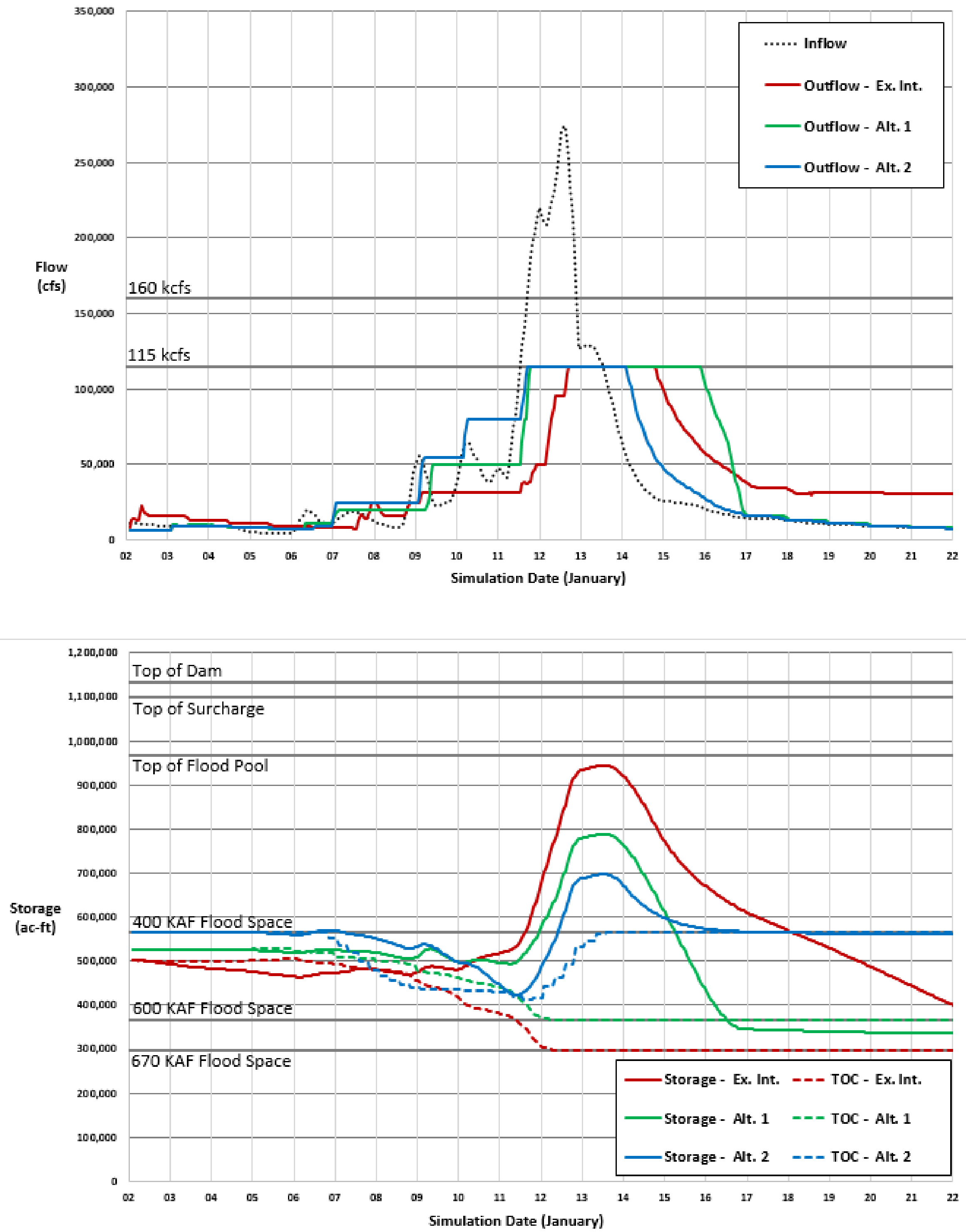

Figure ES-2. Scaled 1-in-100 annual exceedance probability event pattern of the 1997 storm event depicting releases from (top) and flood storage volumes in (bottom) Folsom Lake throughout the event.

Note: E504 is the No Action/No Project, J602P3 is Alternative 1 – Basin-wetness Operations, and J602F3 is Alternative 2 – Forecast-informed Operations

Due to its ability to route larger events at the objective release targets (see Figure ES-3) and the greater efficiency in which it balances flood storage and water storage purposes, Alternative 2 –

Forecast Informed Operations with Variable Folsom Flood Control Space (400,000 af to 600,000 af), was identified as the tentatively selected plan and, along with the No Action/No Project Alternative, was analyzed in detail for their affects to the human environment.

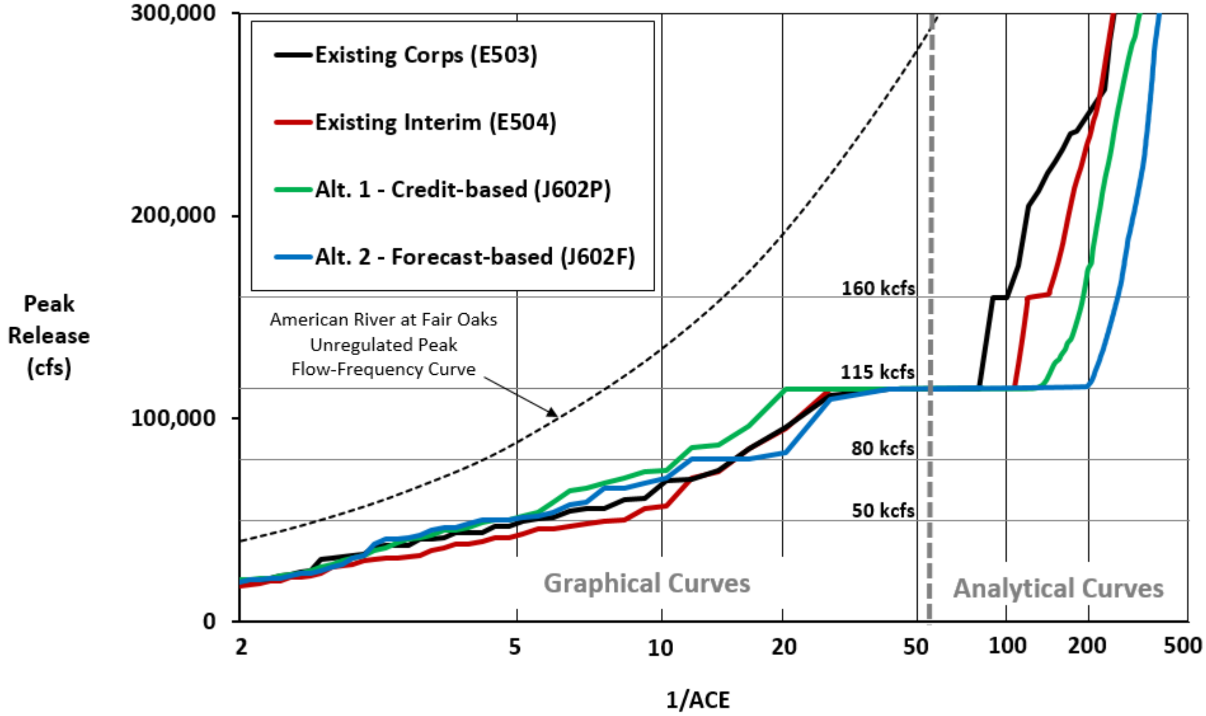

Figure ES-3. Lower American River Flow Frequency Curves of the Operation Scenarios Modeled for the Manual Update.

Note: E504 is the No Action/No Project, J602P3 is Alternative 1 – Basin-wetness Operations, and J602F3 is Alternative 2 – Forecast-informed Operations. The existing USACE (E503) curve reflects only the 1986 event pattern hypothetical events. Four hypothetical event patterns (1956, 1964, 1986, and 1997) are reflected in the E504, J602P, and J602F curves.

No Action/No Project

Under No Action/No Project, USACE would not update their latest Folsom Dam WCM (1986). USACE would continue to prescribe flood operations at Folsom Dam based on the 1986 fixed space water control diagram (WCD) (400,000 af) and release capabilities provided by the original dam outlets. Under No Action/No Project, Reclamation and SAFCA would extend their Interim Agreement and continue to operate the dam based on their 400,000 af to 670,000 af variable space WCD, utilizing only the original dam outlets.

However, Reclamation has indicated that they would operate the JFP in the absence of an updated WCM, if necessary, in the extremely rare event where the structural integrity of the dam was at risk of failure. The Reclamation Safety of Dams Act, as amended (P.L. 95-578), authorizes the agency to "construct, restore, operate, and maintain new or modified features at existing Federal reclamation dams for safety of dams purposes." Reclamation would proceed with such actions only after coordinating fully with USACE, CVFPB, SAFCA, and other cooperating agencies of the Federal-State Flood Operations Center in Sacramento. For the purposes of this analysis, the No Action/No Project condition has four essential elements to be retained under the 2004 Interim Agreement as explained below:

- Release Schedule: The water stored in the designated flood control space in the reservoir must be released as rapidly as possible. As a result, the release schedule permits simultaneous use of the five main spillway bays and the eight river outlets at the dam. The maximum specified (objective) release is 115,000 cfs. However, during relatively small flood events, the outflow is limited to the maximum inflow. Any change in outflows is limited to 15,000 cfs per 2-hour period when inflows are increasing, and 10,000 cfs per 2-hour period when inflows are decreasing. When the spillway gates and river outlets are operating simultaneously (between elevation 423.6 feet msl and 447 feet msl), the gates on the river outlets are set in a 60 percent open position to avoid cavitation damage to the spillway and outlet conduits.
- Reservoir Storage Schedule: The water conservation pool must be reduced to no more than 577,000 af (400,000 af empty) at the beginning of each flood season if the three upstream reservoirs (French Meadows, Hell Hole, and Union Valley) have 200,000 af or more empty space at that time. This target must be met by November 17 and maintained unless, based on a daily evaluation, the storage space upstream falls below 200,000 af. At that point, the Folsom Reservoir pool must be reduced in accordance with the storage schedule. For example, a decline to 175,000 af of empty space in the three upstream reservoirs requires a reduction in storage in Folsom Reservoir to 552,000 af, while a decline to 130,000 af of empty space in the three upstream reservoirs requires a reduction in storage in Folsom Reservoir to 477,000 af. To calculate the total amount of creditable empty space in the upstream reservoirs, French Meadows Reservoir has a maximum of 45,000 af, Hell Hole Reservoir has 80,000 af, and Union Valley Reservoir has 75,000 af of creditable storage. Empty space in excess of these amounts at each of the upstream reservoirs is not creditable.
- Adjusted Reservoir Storage Schedule: If one or more of Folsom Dam's power penstocks is lost for more than 1 day, the reservoir storage schedule must be modified to provide additional flood control reservation in accordance with the adjusted reservoir storage schedule shown in the right hand corner of the WCD. For example, under this adjusted schedule, when the Folsom Reservoir pool is 425,000 af, a single power penstock outage would require that the pool must be reduced to 395,000 af.
- Contractual Commitments: Pursuant to 1999 WRDA, as amended, the Interim Agreement includes the following contractual commitments to avoid potential adverse effects of the operation:
    a. SAFCA will contribute funds to purchase replacement water if conditions arise which indicate that operating Folsom Dam and Reservoir in accordance with the Interim Agreement causes a water shortfall, which results in significant effects on recreation at Folsom Reservoir.
    b. SAFCA will compensate the El Dorado Irrigation District (EID) for any incremental increase in pumping costs incurred by EID as a result of the reservoir operation.
    c. SAFCA will compensate purveyors using the Folsom Pumping Plant for non-CVP water for any incremental increase in pumping costs (i.e., the San Juan Water District and the City of Roseville).

d. SAFCA will coordinate with the State of California's Historic Preservation Officer (SHPO) and the U.S. Advisory Council on Historic Preservation (ACHP) to ensure compliance with Section 106 of the National Historic Preservation Act (NHPA).

Although all flood risk management and dam safety features of the JFP would be completed at Folsom Dam, the new auxiliary spillway would not be operated for flood risk management under the No Action/No Project Alternative because a new water control plan was not approved to prescribe its operation and no environmental compliance documents completed to allow for its long-term use. As a result, the flood risk management benefits of the JFP, as well as any benefits of improved forecasting capabilities from the NWS, would not be realized.

Additionally, without preparation and implementation of the Manual Update, USACE would not be in compliance with congressional direction in Sections 101(b) and 101(e) of WRDA 1999 as quoted in Section 1.2.1. That is, the variable space allocated to flood control within the reservoir would not be reduced from the current operating range of 400,000–670,000 af to 400,000–600,000 af, and the flood management plan for the American River Watershed would not reflect the operational capabilities of the JFP or improved weather forecasts of the NWS to reduce the flood risk to the Sacramento area.

Alternative 2 – Forecast Informed Operations with Variable Folsom Flood Control Space (400,000 af to 600,000 af) (Selected Plan)

USACE best practice of operating to "rain on ground" is of limited utility at Folsom for informing flood operations, as this reflects only about the last 8 to 12 hours of precipitation. In other words, excess precipitation on the watershed enters the reservoir quickly, allowing only hours for operational decisions to be made and implemented. Use of forecast information provides potential for extending this time window, or lead time. The current WCM contains general language indicating that forecast information should be considered in the process of making release decisions. Alternative 2-forecast-informed operations formalizes, in operational rules, the required releases which would be made as a result of quantitative inflow forecast information received.

The California-Nevada River Forecast Center (CNRFC) already operates a sophisticated precipitation runoff model of the watershed upstream of Folsom Lake. The model is updated with observed data including measured precipitation, current storage levels at headwater reservoirs, and the current inflow into Folsom Lake. It is further supplied with an ensemble of precipitation forecasts. As such, the resulting CNRFC inflow forecasts already account for the wetness of the watershed *and* upstream storage. The resulting forecast products do not require further processing or application of analysis-based relations to account for these characteristics.

Alternative 2 relies on forecast information generated by CNRFC, who support the use of this information to guide flood operations at Folsom. In the inflow forecast alternative, this information is used for two purposes: 1) to compute a forecast-based top-of-conservation storage elevation (TOC) during the portion of the year in which variable flood space is in effect, and 2) if the reservoir is encroached above the forecast-based TOC, to compute the required release. The intended effect of this approach is to initiate releases greater than inflow in advance of the main wave(s) of the event. This operation results in drawdown of the reservoir prior to arrival of the main event, making more space available for routing.

The updated WCD and emergency spillway release diagram (ESRD) developed for Alternative 2 is shown in Figure ES-4 and Figure ES-5, respectively. Alternative 2 achieved the flood performance goal of routing 1/100 and 1/200 AEP events at 115,000 and 160,000 cfs respectively. In addition, updates to the ESRD enabled Alternative 2 to successfully route the PMF event with three feet of freeboard. The ESRD shown in Figure ES-5 shows the ESRD at the time of analysis. The ESRD has since evolved further, with inflow curves to the left of the 115 kcfs vertical line removed. Removal of these curves does not affect analysis results.

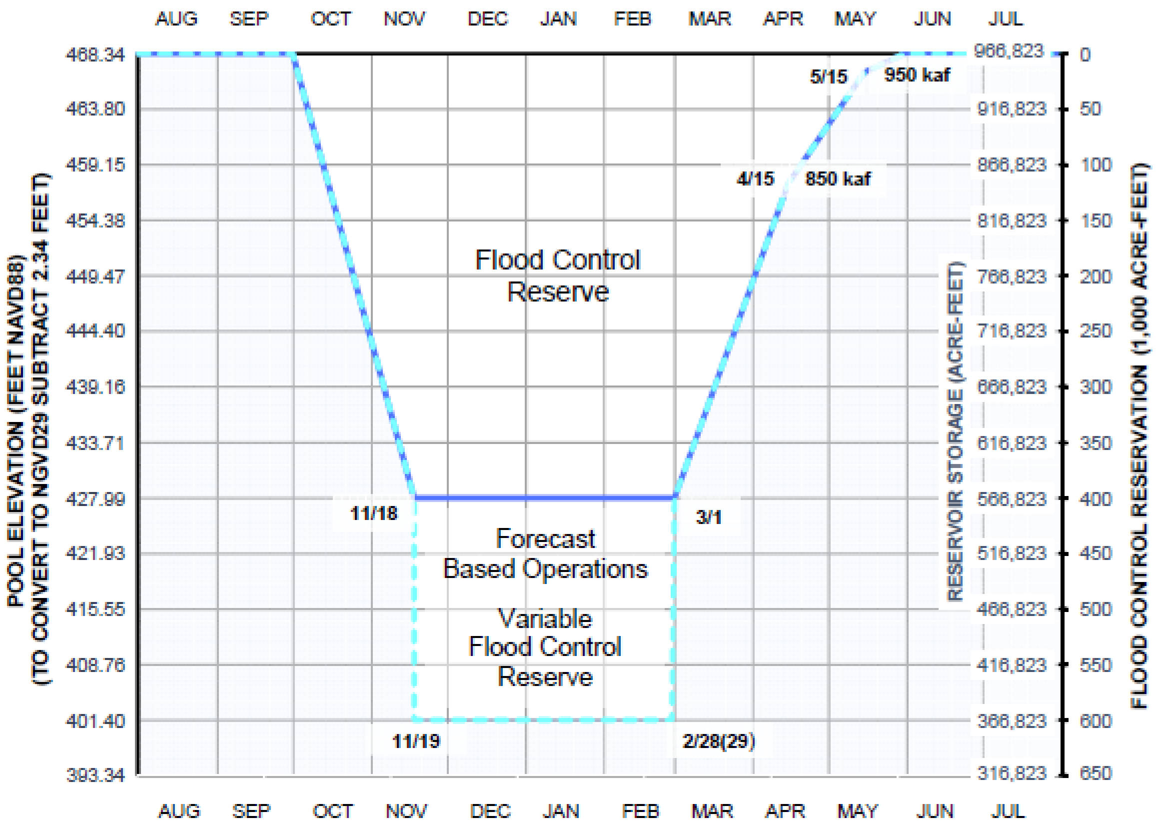

Figure ES-4. Updated Water Control Diagram for Alternative 2.

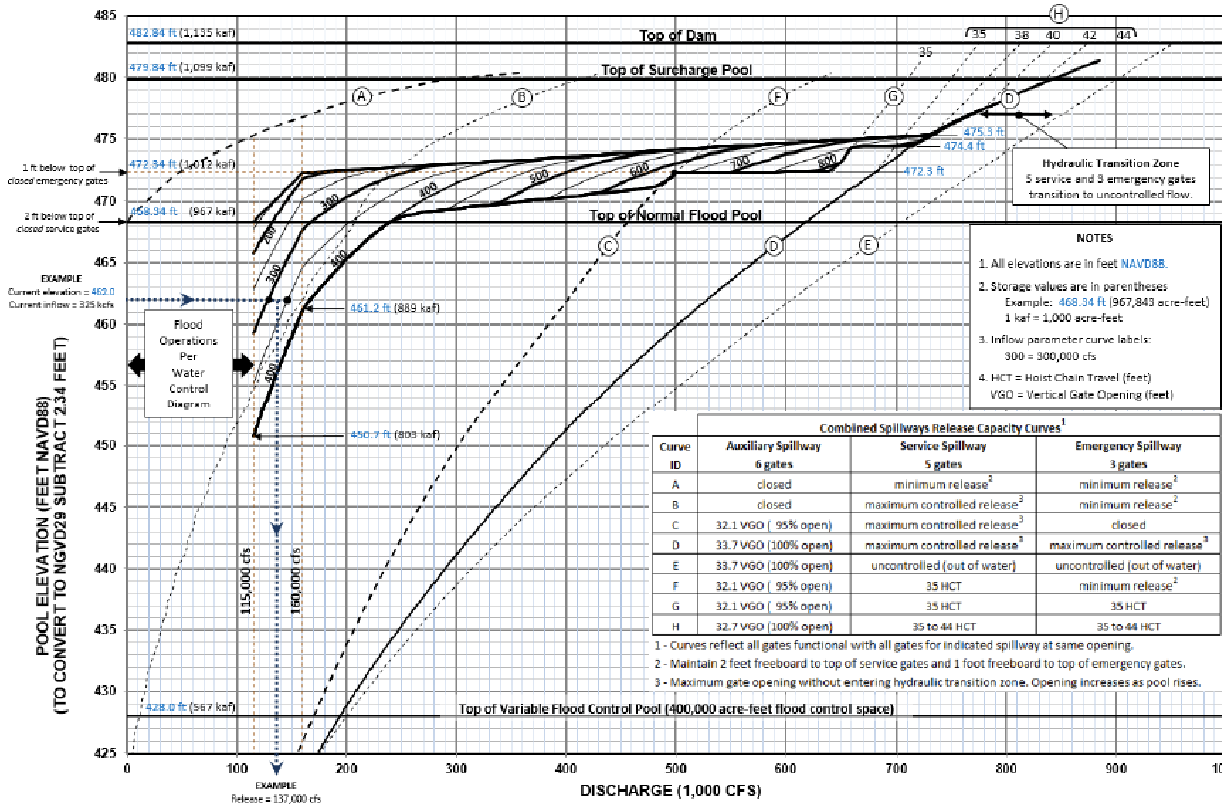

Figure ES-5. Updated Emergency Spillway Release Diagram for Alternative 2.

Inflow forecasts present unique challenges in developing a reservoir operation scheme. The primary challenge is the simple fact that forecasts are not perfect: forecasted volumes are not exactly the same as the actual inflow volumes. While forecast skill has been improving over the years, and will continue to improve, understanding and accounting for the degree of variability in forecasts is required. A second challenge is given the variability of forecasts, and variability of inflows even if forecasts were perfect, there is a need to make well-behaved (non-erratic) releases. This is an important consideration for dam operations as well as minimizing downstream effects and supporting coordination efforts.

The rules proposed to address the degree of variability in forecasts and the variability of inflows so that effects to dam operations and downstream resources are minimized are discussed in more detail below.

Forecast-based Top of Conservation

During the period of variable flood space on the WCD, the TOC is computed as a function of forecasted inflow volumes into Folsom Lake. Four forecast durations are considered: 24 hours, 48 hours, 72 hours, and 120 hours (1-, 2-, 3-, and 5-day). The volumes associated with these durations are cumulative, meaning that the 5-day volume includes and will always be greater than the 1-, 2-, and 3-day volumes. Forecast volumes for these durations will be provided by CNRFC during operation, on a 6-hour time step during large events, and more frequently during an event if requested by Reclamation or USACE.

Use of the diagram shown in Figure ES-6 requires the operator to first receive the four forecast volumes, one for each duration, from CNRFC (volumes will be provided in af). For each duration, the forecast volume is located on the x-axis, and the corresponding candidate TOC is located on the y-axis using the indicated relation for that duration. This exercise is completed for each of the four forecast volumes. Finally, the minimum (lowest) candidate TOC values is adopted as the TOC.

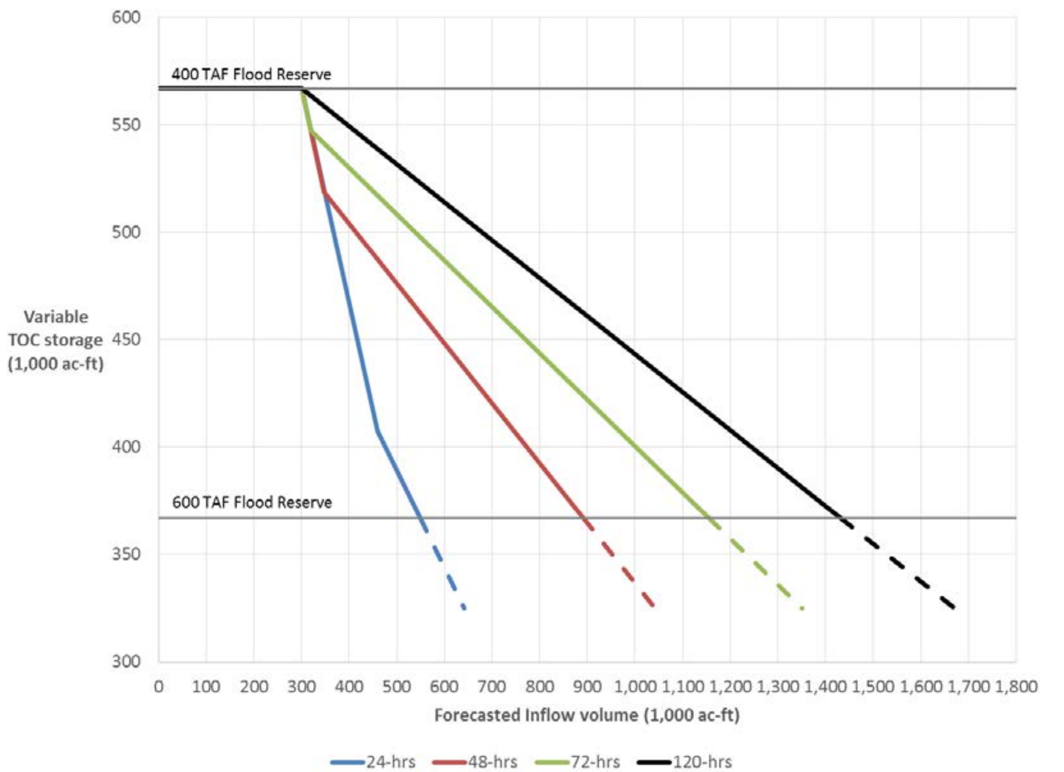

Figure ES-6. Forecast-based Drawdown Relationships.

Forecast-based Releases

Forecast-based releases are made when the TOC drops below the maximum TOC value shown on the water control diagram, and the actual storage is above the TOC. In this condition, the storage is encroached into the flood space, and forecast-based flood releases are required. The proposed approach allows for two modes of operation: non-flood operations and flood operations, the distinction being whether or not the current pool elevation is greater or less than the TOC. The reservoir is in a non-flood (conservation) mode of operation except when a major event is underway. During this time, TOC is at the maximum level defined by the WCD. As an event approaches and forecasts drive the TOC down (forecast volume greater than 300,000 af [300 TAF]), the TOC may drop below the storage if the actual storage is sufficiently high. At this point in time the reservoir becomes encroached and switches to a flood operation mode. In this mode, releases are informed based on forecast information as well as actual inflows until the TOC returns to the maximum value on the WCD.

In order for forecast-based releases to be effective, releases greater than inflow must be made prior to the arrival of the main wave of the event. Because of constraints, such as operational delays, ramping rate restrictions, and channel capacity, there is only a limited time window in which effective releases can be made. Therefore it is necessary to start the process of making releases early, relying on longer range forecasts. At Folsom, this means using the 5-day forecast volume as the trigger for initial forecast-based releases.

Stepped releases for Alternative 2 would be made as indicated in Table ES-1. The first column shows the release step targets as they relate to inflow into Folsom Reservoir. As indicated in the second column, from October 1 to November 18 and from March 1 to June 1, releases would follow current inflow, subject to rate of increase constraints. During the period of variable flood reserve, from November 19 to February 28, stepped releases would be made in response to the forecasted inflow volumes. Column three shows that 300 TAF is the threshold volume for all four forecast durations. Once the 5-day volume increases above 300 TAF, the target release is 25,000 cfs. The next release steps of 50,000 cfs and 80,000 cfs are triggered when the 3-day and 2-day volumes exceed 300 TAF respectively. The largest forecast-based release step of 115,000 cfs, the normal objective release, is triggered when the 1-day volume exceeds 300 TAF and the current inflow is at least 115,000 cfs. Releases above 115,000 cfs are governed by the ESRD, and are a function of current pool elevation and current inflow.

Table ES-1. Stepped Release Thresholds for Alternative – Forecast-informed Operations.

Release Steps	Matching Inflow Thresholds (Oct. 1 to Nov. 18 and Mar. 1 to Jun. 1)	Forecast-based Inflow Volume Thresholds (Nov. 19 to Feb. 28)
25,000 cfs	Release maximum event inflow	5-day volume > 300 TAF
50,000 cfs	Release maximum event inflow	3-day volume > 300 TAF
80,000 cfs	Release maximum event inflow	2-day volume > 300 TAF
115,000 cfs	Release maximum event inflow	1-day volume > 300 TAF and current inflow >= 115,000 cfs

The updated water control diagram reflecting the proposed action is shown in Figure ES-7.

ES.5. AFFECTED ENVIRONMENT

The Manual Update would only involve modifying the flood risk management and dam safety operations of the Folsom Dam and Lake Project. There would be no construction or modification of any of the existing structural features of the dam, reservoir, or associated infrastructure. As a result, this SEA/EIR assumes that there would be negligible to no effects on environmental resources not related to the timing, rate, or volume of flood releases from the dam. These resources include geology; topography; air quality; climate and climate change; traffic and circulation; noise/vibration; hazardous, toxic, and radiological waste; environmental justice; and esthetics/visual resources.

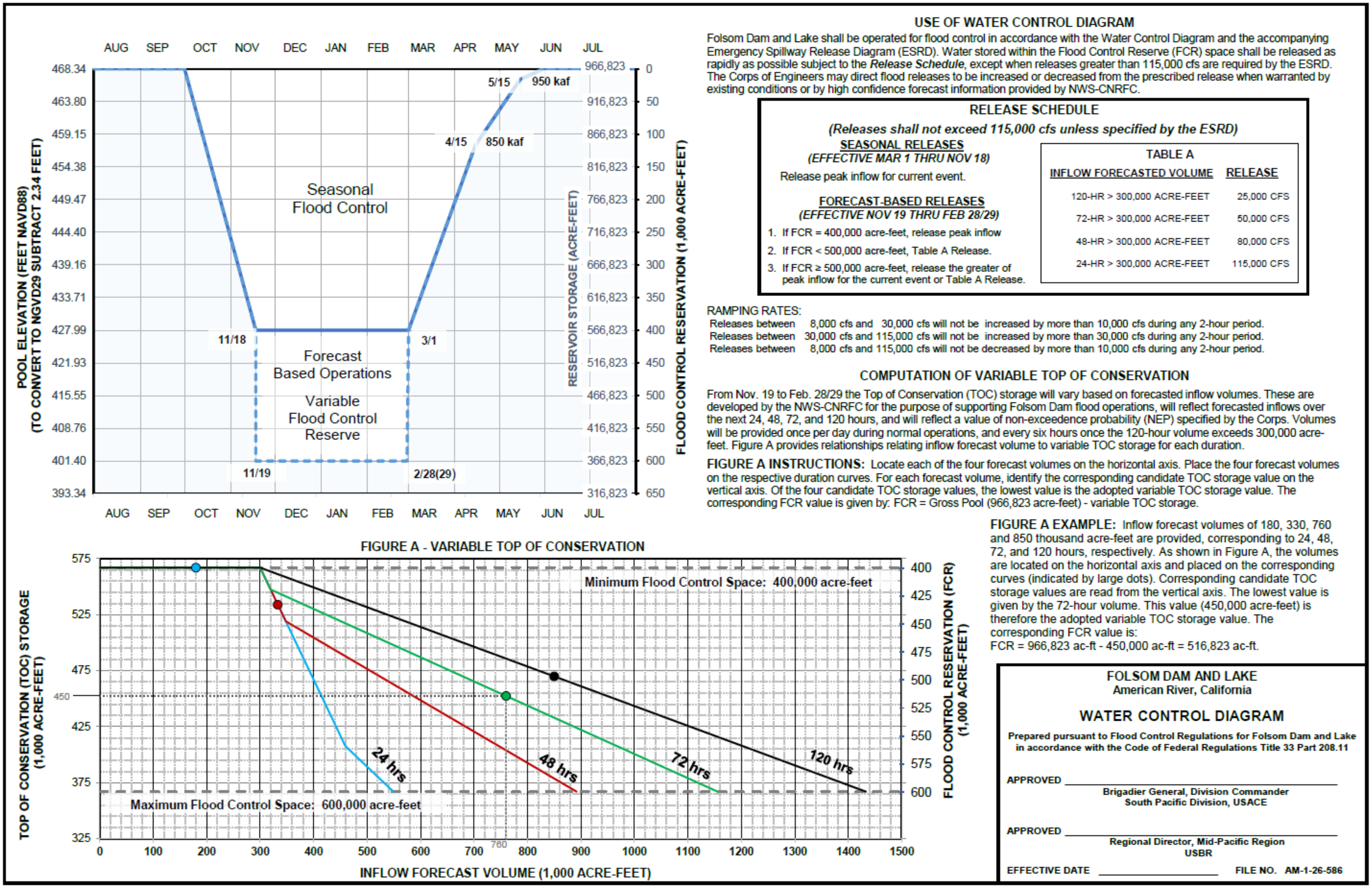

Figure ES-7. Draft Folsom Dam Forecast-informed Operations Water Control Diagram.

The resources that could be related to the timing, rate, or volume of flood releases are evaluated in detail in this SEA/EIR and include hydrology, hydraulics, water quality, terrestrial vegetation and wildlife, fish and aquatic resources, special status species, water supply and delivery, hydropower production and distribution, recreation, and cultural resources. This list is also consistent with those resources identified as being of particular concern to stakeholders, agencies, and/or the public during scoping, i.e., erosion and water quality, water supply, power generation, listed and sport fisheries, and recreation.

ES.6. ENVIRONMENTAL EFFECTS AND MITIGATION

Table ES-2 at the end of this executive summary summarizes the adverse and beneficial effects of the alternatives, potential mitigation measures, and significance before and after implementation of mitigation measures.

ES.7. COMPLIANCE WITH APPLICABLE LAWS

This document is being adopted as a joint SEA/EIR and fully complies with NEPA and CEQA requirements. The project will comply with all Federal laws, regulations, and Executive Orders. In addition, the non-Federal sponsor will comply with all State and local laws and permit requirements.

ES.8. PUBLIC INVOLVEMENT

The Lead Agencies have implemented a comprehensive public participation program to fully inform and engage affected agencies, stakeholders and communities. In addition to the 30-day NEPA/CEQA public scoping process, a Stakeholder Engagement Plan was developed for the Manual Update based on seven discussion sessions that USACE, in partnership with Reclamation, SAFCA, and CVFPB/DWR, convened with the stakeholders (See *Stakeholder Situational Assessment Folsom Dam Water Control Manual Update*, 2013). Various stakeholder groups desired different levels of engagement in the Manual Update. As such, the Stakeholder Engagement Plan consisted of multiple venues for stakeholders to provide feedback on the Manual Update.

Starting in the fall of 2013 and continuing throughout the development of alternatives, USACE convened periodic public outreach meetings. These meetings provided the venue for policy and technical discussions on the Manual Update. The meetings were publicly noticed, including invitations to the regional business community, emergency management and response agencies, lower Sacramento River and north Delta interests, and other interested parties.

Following completion of the Draft SEA/EIR, USACE and CVFPB distributed the document to interested or affected agencies, groups, and individuals for review and comment. The public review began on June 7, 2017 and ended on July 21, 2017. A series of public meetings were held within the Manual Update project area during the 45-day public review on June 14, 2017 at the Sacramento City Library, and on June 15, 2017 at the Folsom Community Center. All comments received were considered and incorporated into the final document, as appropriate. All comments and resposonses are included in Appendix G.

ES.9. AREAS OF CONTROVERSY

In September 2013, a Stakeholders Situational Assessment was conducted for the Manual Update. For the most part, stakeholders had more commonality among their interests than differences. The six challenges listed below reflect not only potential differing perspectives among the stakeholders but also possible differences between the government agencies working on the Manual Update and the various stakeholder groups.

- Flood Risk Reduction and Water Supply: Given the relatively small size of Folsom Reservoir, there has been a historic tension between flood risk reduction and water availability for municipal, environmental, agricultural, hydropower and recreational purposes. Among those concerned with water availability, there is not enough water even under optimal conditions to satisfy all the needs. In the context of the Manual Update, the balancing act of neither releasing water "too late" nor "too early" from Folsom Reservoir is not an easy one. Even when more is learned about accurately predicting such parameters as precipitation and basin wetness, there will always be uncertainties. Although the Manual Update rules will be the decision of USACE in consultation with its partner (Reclamation), and its state and local cost-sharing sponsors (CVFPB/DWR and SAFCA), exactly how to balance these uncertainties in the Manual Update could be an area of tension among stakeholders.
- Water from Conditional Storage: If conditional storage results in additional water yield from increased seasonal storage, there are likely to be differences of opinion among the stakeholders on "when" (timing) and "how much of" (amount) this water is used. The recreational, environmental, in-basin purveyors, electric power utilities and CVP/SWP contractors are the groups with an interest in this issue. Any additional water yield gained from conditional storage is the responsibility of Reclamation to manage under its CVP water rights authority.
- Flexibility of Manual Update: Achieving the appropriate balance between operational flexibility and fixed operational rules is a challenge that is likely to be viewed differently by the various stakeholder groups.
- Use of Basin Wetness Information: The In-Basin Water Purveyors have expressed a strong interest in monitoring, collecting and using basin wetness data as part of the guidance parameters in this Manual Update. Their concern is that the government agencies working on the Manual Update may be more cautionary in their use of basin wetness data than they (In-Basin Water Purveyors) believe is warranted.
- Use of Weather Forecasting Information: Based on weather forecasts for big storms, the Environmental stakeholders have expressed a strong interest in early and aggressive Folsom Dam releases, including releases that could exceed in-flows into the Reservoir. Their concern is that the government agencies working on the Water Control Manual and possibly the water suppliers may be more cautionary in their use of weather forecasts than they (Environmentalists) believe is warranted. The National Weather Service will provide consultation to the government agencies producing the Manual Update, thereby possibly reducing the level of this challenge.

- Cold Water Pool: Although the government agencies responsible for the Manual Update have determined that improvements to the cold water pool are incidental to the main purpose of the Manual Update, the Environmental stakeholders would like more consideration given to the cold water pool issues due to the important role cold releases play in the health of the fisheries. Reclamation and SAFCA have offered to convene side conversations on this issue, apart from the discussions on the Manual Update. What can be done now to improve Folsom's cold water pool is a challenge unto itself. The Temperature Control Device for Folsom is part of the future Dam raise, which is not scheduled to be constructed until 2019.

ES.10. UNRESOLVED ISSUES

Compliance with WRDA 1999

Without preparation and implementation of the Manual Update, USACE would not be in compliance with congressional direction in Sections 101(b) and 101(e) of WRDA 1999 as quoted in Section 1.2.1. That is, the variable space allocated to flood control within the reservoir would not be reduced from the current operating range of 400,000–670,000 af to 400,000–600,000 af, and the flood management plan for the American River Watershed would not reflect the operational capabilities of the JFP or improved weather forecasts of the NWS to reduce the flood risk to the Sacramento area.

ES.11. SELECTED PLAN

Based on the results of the technical and environmental analysis, coordination with the non-Federal sponsor, and public input, Alternative 2 is identified as the selected plan.

TABLE ES-2. SUMMARY TABLE OF IMPACTS

No Action/No Project Alternative	Alternative 2 – Forecast-informed Operation
Hydrology and Hydraulics	
Local Project Area	
Floodwaters would continue to be expected to overtop levees in the lower American River at the 1 in 150 annual chance exceedance event. There would be no change in existing exposure to loss, injury, or death due to flooding. Implementation of the authorized American River Common Features Project GRR erosion protection measures will reduce existing channel widening to less than significant in the leveed portion of the lower American River.	Alternative 2 is capable of passing more rare events at the normal and emergency objective releases than No Action/No Project. Alternative 2 can hold an annual chance exceedance event of 1 in 237 to the 160,000 cfs emergency objective release. This represents a beneficial effect of reducing exposure of people or structures to a significant risk of loss, injury or death involving flooding. In general, existing channel widening rates are not expected to change significantly under Alternative 2 operations, particularly with American River Common Features GRR erosion protection features in place. Given the consistency between degradation/ aggradation trends of No Action/No Project and Alternative 2, effects to long term sediment transport processes are expected to be less than significant. All potential effects would be less than significant.
Water Quality	
Regional Effects Assessment Area	
Excess water will continue to be released prior to the start of flood season. During dry years, water will continue to be allocated based on current regulations. Existing issues with salt water intrusion into the Delta in dry years would continue due to water shortfalls.	Alternative 2 conditions would be generally similar to No Action/No Project conditions for long-term averages and generally similar most of the time during all water year types for net Delta outflow, E/I Ratio, and X2 position. Modeling results for Rock Slough chloride parameters show generally similar long-term average values and generally similar values most of the time during all water year types. All potential effects would be less than significant.
Vegetation and Wildlife	
Local Project Area	
Average peak flows, release rates and surface water levels would be expected to remain the same. Vegetation and special status species in the local project area would continue to be influenced by the current flow regime. During dry water years, there would continue to be less cold water available to sensitive aquatic species. River levels would remain low during summer months. The upper banks and floodplains would continue to be inundated periodically during large storm events.	Alternative 2 is expected to provide more flows that would have a beneficial effect to no effect on cottonwood growth. Flows would not be changed by sufficient magnitude and frequency to substantially alter the existing backwater habitats dependent on the lower American River. Therefore, effects to backwater recharge would be negligible to less than significant. Slight increases in mid-range flow frequencies could affect erosion rates and channel widening in some subreaches of the lower American River. However, implementation of the American River Common Features GRR would reduce these risks. Additionally, monitoring would occur as part of Alternative 2 to ensure erosion does not exceed the allowable take as specified in the USFWS BO (Appendix K). Monitoring would cease

No Action/No Project Alternative	Alternative 2 – Forecast-informed Operation
	if it is determined that erosion is not adversely impacting subreaches 7 & 8 and if eroded areas are at least 50% revegetated within 5 years. Given the less than significant effect of Alternative 2 on cottonwood growth and backwater recharge in the lower American River, and implementation of additional monitoring of riparian habitat, no significant adverse effects are expected to occur to special-status plant and animal species within the local or regional project area
Fisheries	
Local Project Area	
Folsom Dam and Lake would continue to operate under the existing SAFCA/Reclamation interim agreement and the new auxiliary dam would not be utilized except in extremely rare circumstances. Average peak flows, release rates and surface water levels would be expected to remain the same. Current operations do not retain enough cold water to facilitate cold water releases during the warmest months to provide maximum thermal benefits for listed fish species. American River flows would continue to be influenced by numerous requirements and regulations, including the current Fall X2 Delta outflow, water quality temperature criteria, Folsom Dam flood storage requirements and Delta exports, all of which would be expected to remain unchanged. High water demand in the local and regional effects assessment area will continue to limit the amount of cold water available to the American River and suitable habitat for salmonids and other sensitive species downstream. Gravel augmentation will continue to be required in the American River.	Long-term average monthly flows below Nimbus Dam under Alternative 2 relative to No Action/No Project are generally slightly lower during November through February and August, and slightly higher during March through June, September, and October. Simulated monthly water temperatures at representative locations in the lower American River indicate that water temperatures under Alternative 2 relative to the No Action/ No Project would generally be similar most of the time in the lower American River, but with measurable reductions in water temperature during late spring, summer, and early fall months throughout the river, with measurable increases in water temperature during March and August. These slight changes would not result in a significant impact to any fish species in the local project area. While updated sediment transport modeling indicated a slight increase in channel degradation potential in the upper third of the lower American River, the overall effects on spawning gravel mobilization are considered to be an improvement over the existing No Action/No Project alternative, and not likely to adversely affect sensitive fish species with the continued implementation of USBR's CVPIA spawning gravel augmentation program. However, SAFCA will supplement the existing gravel augmentation program with 300 short tons/year of spawning gravel to compensate for impacts from increased frequency of mid-range flows (30,000-80,000 cfs). These mid-range flows will be minimized under Alternative 2 to the extent practicable, when conditions warrant. Additionally, SAFCA will implement or contribute to a monitoring program to evaluate movement of spawning gravel in the upper reach of the lower American River.
Regional Effects Assessment Area	
Same as Local Project Area.	Modeled flows were consistent with the modeling results from the 2016 Coordinated Long Term Operation of the Central Valley Project and State Water Project EIS for spring-run Chinook salmon, fall-run Chinook salmon, steelhead, river lamprey, Pacific

No Action/No Project Alternative	Alternative 2 – Forecast-informed Operation
	lamprey, and hardhead. Results for long-term average flows, average flows by water year type, and flow exceedance probabilities during all years and during low-flow conditions were equivalent for the Alternative 2 relative to the No Action/No Project condition. In the Feather River, in particular, model results for flows in the Low Flow Channel below the Fish Barrier Dam were shown to be consistent with the terms of the California Department of Water Resources' agreement with the California Department of Fish and Wildlife. With less use of the variable space flood storage and greater capacity to capture spring-refill, Alternative 2 provides more flexibility in managing conservation storage to meet regional effects assessment area fisheries requirements than does the No Action/No Project operations. The overall effects of implementing Alternative 2 are negligible to less than significant and meet regional fisheries requirements. Therefore, affects to regional effects assessment area fisheries would be considered consistent with existing CVP-SWP operations, any differences are simply minor fluctuations due to model assumptions and approaches, and are thus negligible to less than significant.
Water Supply and Distribution	
Local Project Area	
Existing conditions would be expected to remain relatively unchanged. Contractual commitments detailed in the 2004 Interim Agreement and 2006 American River Division Long Term Contract Renewal EIS would continue.	In general, model outputs for storage in Folsom Reservoir for Alternative 2 are higher than No Action/No Project. CalSim II model outputs indicate that the overall condition with the forecast operations in place at Folsom Dam would be generally similar or better than conditions with existing operations at Folsom. Therefore, overall effects to water supply and demand in the local project area would be considered less than significant.
Hydropower	
Local Project Area	
There would not be any changes to the current hydropower operations at Folsom or Nimbus Dams and existing conditions would be expected to remain the same.	The model results for Alternative 2 indicate minor increases and decreases in net power generation. These differences are so small (1 percent range or less) that they are within the bounds of model error and are not considered significant. In addition, these minor changes would not cause an increase or decrease in use of hydrocarbon-based energy generation sources. Implementation of Alternative 2 - would have a less than a significant effect on hydropower production and distribution, and would not generate a significant change, either positively or negatively, on greenhouse gas emissions.
Recreation	

No Action/No Project Alternative	Alternative 2 – Forecast-informed Operation
Local Project Area	
Water available for recreational purposes would be expected to remain relatively unchanged from existing conditions.	Lower American River: Maximum and minimum optimal flows for recreation range from -2.1 to 2.4 percent. There is a positive effect on the minimum adequate flow of 1,750 cfs, which ranges from 2.4 to 16.9 percent and is met more frequently under Alternative 2. Therefore, the effects that Alternative 2 would have on recreational flows on the lower American River would be considered less than significant and are consistent with the American River Parkway Plan and Wild and Scenic Rivers Acts. Folsom Reservoir: Folsom Reservoir elevations associated with access to boat ramps and swimming locations require a 435ft elevation. CalSim II and HEC-ResSim modeling indicates the 435ft surface elevation is met or exceeded more frequently with Alternative 2 in every month except for June. Overall, the results do not rise to a level of significance as they do not exceed the 5 percent threshold significance for modeling output. Therefore, there would be negligible to no effect on recreational boat ramps or swimming locations.
Cultural Resources	
Local Project Area	
Existing processes of erosion and wet-dry cycles within the reservoir would continue and the current release of potentially erosive flows from the dam would also carry on. Historic properties that exist within the reservoir and downstream would continue to be slowly degraded over time.	Model results based on an 80 year period of record suggest that the Alternative 2 operation would result in generally more stable lake levels at Folsom Reservoir, which would decrease the rate of site decay through most of the reservoir drawdown zone. However, at elevations between 426 feet and 430 feet, the model predicts an increase in wet/dry cycles that could increase degradation of any cultural resources located on the lake bed at those elevations. Lower American River: Sediment transport is understood to begin around 30,000 cubic feet per second (cfs) and therefore this is also the flow above which bank erosion is possible. Alternative 2 would slightly increase the frequency of flows between 40,000 cfs and 90,000 cfs. However, the course of the American river downstream of Nimbus dam is not equally susceptible to this increased erosion. Analyses suggests that the highest risk of channel widening erosion exists in unarmored portions of subreach 8. Some channel widening may also occur in subreaches 1-4 and 7, but less than would be expected in subreach 8. In addition, portions of subreaches 5, 6, and 9 may experience slight additional erosion relative to existing operation of Folsom Dam. The Programmatic Agreement contains mitigation measures for both the reservoir pool and Lower American River.Effects to historic properties may be considered potentially significant under CEQA. A potentially significant impact is one that if it were to occur, would be considered to be a significant impact. However, since the occurrence of the

No Action/No Project Alternative	Alternative 2 – Forecast-informed Operation
	impact cannot be immediately determined with certainty, a potentially significant impact is treated as if it were a significant impact. Since impacts are unknown, it is unclear if mitigation measures will reduce impacts to less than significant. Therefore, for CEQA purposes, impacts to cultural resources remain potentially significant.

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ACRONYMS AND SHORTENED FORMS

af	acre-feet
ACE	Annual chance of exceedance
AMSL	Above mean sea level
APE	Area of Potential Effect
BA	Biological Assessment
BMP	Best Management Practice
CAR	Fish and Wildlife Coordination Act Report
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
Cfs	cubic feet per second
CNDDB	California Natural Diversity Database
CNRFC	California Nevada River Forecast Center
CVFPB	Central Valley Flood Protection Board
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CWA	Clean Water Act
DFW	California Department of Fish and Wildlife
DS/FDR	Dam Safety and Flood Damage Reduction
DWR	California Department of Water Resources
EA	Environmental Assessment
EA/EIR	Environmental Impact Statement/Environmental Impact Report
EID	Environmental Information and Documentation Checklist
E-I Ratio	Export to import ratio
ESA	Endangered Species Act
ESRD	Emergency Spillway Release Design
GRR	General Reevaluation Report
FEMA	Federal Emergency Management Agency
FLSRA	Folsom Lake State Recreation Area
FMS	Flow Management Standard
FONSI	Finding of no significant impact
FWCA	Fish and Wildlife Coordination Act
FY	Fiscal Year
IS	Initial Study
ITA	Indian Trust Asset
JFP	Joint Federal Project
Manual Update	Folsom Dam and Lake Water Control Manual Update
M&I	Municipal and Industrial
MBTA	Migratory Bird Treaty Act of 1918
mg/L	Milligrams per liter
Msl	mean sea level
MFR	Minimum Flow Requirement
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service

NOA	Notice of Availability
NOI	Notice of Intent
NOP	Notice of Preparation
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NWS	National Weather Service
OHWM	Ordinary High Water Mark
O&M	Operation and Maintenance
OMR	Old Middle River
PL	Public Law
PMF	Probable Maximum Flood
POR	Period of Record
Reclamation	U.S. Bureau of Reclamation
RWQCB	Regional Water Quality Control Board
ROD	Record of Decision
RWQCB	Regional Water Quality Control Board
SAFCA	Sacramento Area Flood Control Agency
SEA/EIR	Supplemental EA/EIR
SHPO	State Historic Preservation Officer
SWP	State Water Project
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TAF	thousand acre-feet
TOC	Top of Conservation
UO	Upper Optimal Temperature
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UT	Upper Tolerable Temperature
VELB	Valley Elderberry Longhorn Beetle
WAPA	Western Area Power Administration
WCD	Water Control Diagram
WCM	Water Control Manual
WTI	Water temperature index
WUA	Weighted usable area
WRDA	Water Resources Development Act

1.0 INTRODUCTION

The U.S. Army Corps of Engineers (USACE), Sacramento District, in cooperation with the U.S. Bureau of Reclamation (Reclamation), State of California Central Valley Flood Protection Board (CVFPB), and Sacramento Area Flood Control Agency (SAFCA) are evaluating opportunities to reduce the level of flood risk to the Sacramento Metropolitan Area. Potential opportunities include improving flood conveyance along the lower American and Sacramento Rivers, as well as modifying features and operations of the Folsom Dam and Reservoir to increase dam safety and most effectively manage flood risk both above and below the dam.

To fully realize the flood risk management and dam safety benefits of the new Joint Federal Project (JFP), USACE must update the Folsom Dam and Lake Water Control Manual (Manual Update) before the completion of the spillway in 2017. The Manual Update focuses on establishing flood risk management and dam safety operations criteria for Folsom Dam and Lake with the JFP in place. The American River Common Features and West Sacramento projects General Reevaluation Reports (GRR) are currently being designed and evaluated to account for the potential changes in flow and timing of releases as a result of this Manual Update. In addition, both projects assume that any flood risk management operation changes required to implement the Folsom Dam Raise Project will be analyzed in detail in a subsequent Manual Update and accompanying environmental document when detailed designs have been finalized.

Implementation of an updated WCM is considered to be a major Federal action and State "project" subject to compliance with NEPA and CEQA. USACE and CVFPB are preparing a joint Supplemental Environmental Assessment/ Environmental Impact Report (SEA/EIR) to satisfy the environmental evaluation and review requirements of these two laws.

In accordance with NEPA and CEQA, this SEA/EIR has been prepared as a supplement to the Final EIS/EIR prepared in 2007 for the JFP, which includes features that achieve the authorized purpose of the Folsom Dam Modification Project. The 2007 EIS/EIR was prepared jointly by Reclamation and CVFPB, in cooperation with USACE, to evaluate potential effects of the construction of the new auxiliary spillway on environmental and cultural resources in and near the project area. While the 2007 EIS/EIR generally considered the effects of construction, the document did not include a detailed environmental analysis related to operations. As such, environmental impacts associated with the proposed changes and operational impacts is required in supplemental environmental compliance documentation.

The decision was also made that USACE, Reclamation, CVFPB, and SAFCA would review congressional directives related to operations at Folsom Dam and conduct a detailed study of the potential required changes in operation, including updating USACE's WCM. This SEA/EIR focuses on potential effects of alternative operation plans on environmental resources at and near Folsom Dam, but also include a "screening-level" evaluation of effects of these plans on the operation of the Central Valley Project (CVP)/State Water Project (SWP) system. Information in the 2007 EIS/EIR is incorporated by reference, as applicable.

1.1 Background

The effects of the 1986 and 1997 storms raised concerns over the adequacy of the existing flood risk management system, which led to a series of investigations on the need to provide additional protection to Sacramento. The results of these investigations led to authorization of several flood risk management projects in and near the American River Watershed, including the American River Common Features, Folsom Dam Modifications (features now included in the Folsom Dam Safety / Flood Damage Reduction Project, also known as the JFP), Folsom Dam Raise, and the West Sacramento Projects (these projects are described in Chapter 5). Changes in flood risk management operations at Folsom Dam are needed to fully realize the flood risk management benefits anticipated from each of these projects.

Currently, Reclamation and USACE are constructing the JFP at Folsom Dam. Completed in 2017, the JFP is designed to improve the ability of Folsom Dam to manage large flood events by allowing more water to be safely released earlier in a storm event, resulting in more storage capacity remaining in the reservoir to hold back the peak inflow. The goals of the JFP are to (1) reduce flood risk in the Sacramento Metropolitan Area in conjunction with other features of the regional flood risk management system and (2) pass the Probable Maximum Flood (PMF) while maintaining at least 3 feet freeboard to the top of Folsom Dam. These goals are to be accomplished through construction and operation of a new gated auxiliary spillway, with a spillway crest elevation 50 feet lower in elevation than the current gated spillways at Folsom Dam. A rendering of Folsom Dam, including the new JFP auxiliary spillway, is shown in Figure 1-1.

Figure 1-1. Existing Folsom Dam with a Rendering of the New JFP Auxiliary Spillway.

1.1.1 Folsom Dam and Nimbus Dam

The existing Folsom Dam and spillway are composed of a 340-foot-high and 1,400-foot-long concrete gravity section flanked on each side by earthfill wing dams that extend from the gravity section to the abutments (Figure 1-2). In addition to the main section and wing dams, there is one auxiliary dam that retains water at the location of a historic river channel, and eight smaller earthfill dikes that help to impound Folsom Reservoir. The reservoir – better known as Folsom Lake – has a capacity of 967,000 acre feet (af) and a surface area of 11,450 acres. A hydroelectric generating facility is located along the right side of the gravity section to which flow is delivered via three 15-foot diameter penstocks.

Figure 1-2. Existing Folsom Concrete Gravity Dam and Earthen Wing Dams.

The concrete gravity section of the dam includes an ogee crest at elevation 418 feet for both the service and emergency spillways (Figure 1-3). Releases are controlled using five 50-foot-tall by 42-foot-wide radial gates for the service spillway and three 53-foot-tall by 42-foot-wide radial gates for the adjacent emergency spillway. The dam is also equipped with eight outlet conduits through the gravity section, four outlets at elevation 280 feet (upper level) and four outlets at 210 feet (lower level), each having 5-foot by 9-foot slide gates. The downstream ends of the conduits open up on the service spillway face, but during large floods that require spillway operation, releases through the outlets are limited.

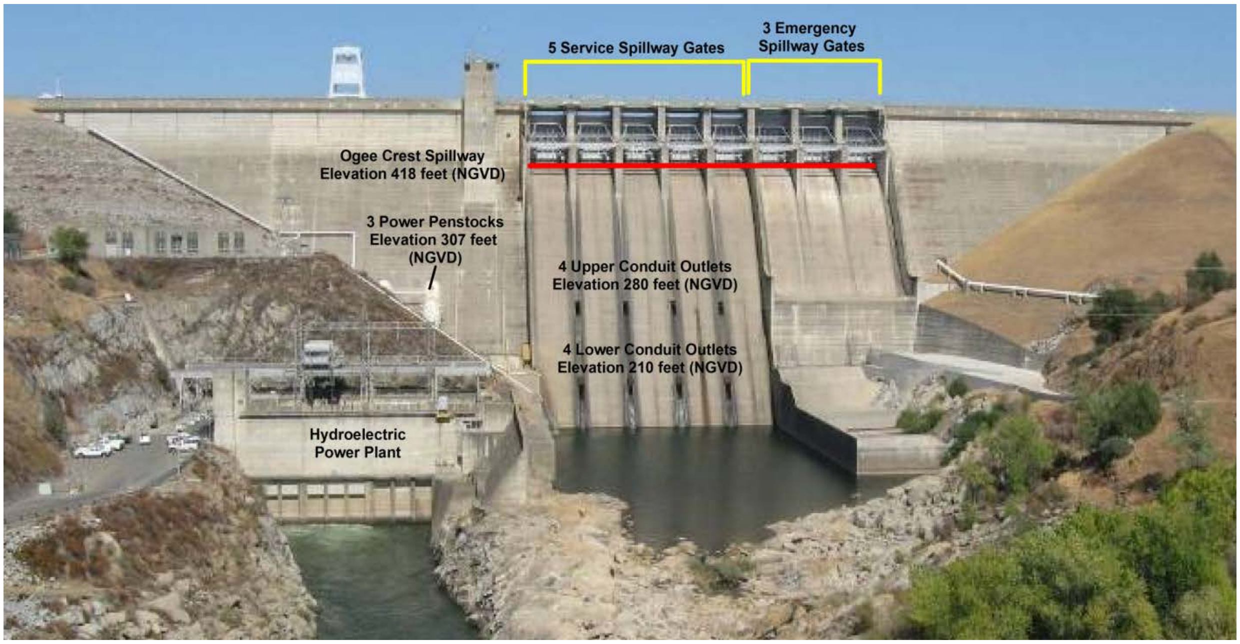


Figure 1-3. Concrete Gravity Section of Folsom Dam.

Lake Natoma is downstream of Folsom Dam and serves as an afterbay to Folsom Reservoir (Figure 1-4). Formed and controlled by Nimbus Dam, Lake Natoma is operated to regulate the daily flow fluctuations created by the Folsom Powerplant. Nimbus Dam, combined with Folsom Dam, regulates water releases to the lower American River. The lower river channel extends 23 miles from Nimbus Dam to the confluence with the Sacramento River. The upper reaches of the lower American River are unrestricted by levees and are hydrologically controlled by natural bluffs and terraces. The lower 13 miles of the river are leveed along both north and south banks. The lower American River is surrounded by the highly urbanized Sacramento Metropolitan Area.

The lower American River is one of the few urban rivers in California that supports relatively large runs of anadromous salmonids, which results in the river receiving high angling pressure during many years. Additionally, anglers target striped bass and American shad seasonally (Sacramento County 2008). Resident rainbow trout are present in the upper segment of the river, and a warm water population of largemouth bass, various sunfish, and catfish make up the remainder of the fishery (Sacramento County 2008). Fishing in the lower American River is permitted year-round, except during fall and early winter when the river is closed to protect spawning Chinook salmon as regulated by CDFW (Sacramento County 2008).

Development of the American River Watershed has modified the seasonal flow and water temperature patterns in the lower American River. Operation of the Folsom-Nimbus Project significantly altered downstream flow and water temperature regimes (NMFS 2009) resulting in higher flows during summer and fall, and lower flows during winter and spring. In addition, operation of Sacramento Municipal Utility District's Upper American River Project since 1962, as well as Placer County Water Agency's Middle Fork Project since 1967, altered inflow patterns to Folsom Reservoir (SWRI 2001).

Prior to the completion of Folsom and Nimbus Dams in 1955, maximum water temperatures during summer frequently reached temperatures as high as 75 degrees Fahrenheit to 80 degrees Fahrenheit in the lower American River (Gerstung 1971). Lower American River summer water temperatures have been cooler in the lower river after Folsom Dam was constructed compared to the pre-dam conditions. However, the tradeoff was the loss of access rearing fish had to cooler habitats throughout the summer at higher elevations (NMFS 2009). In addition, the historic riparian vegetation along the American River formed extensive, continuous forests in the floodplain, reaching widths of up to 4 miles (Water Forum 2005). Nineteenth and early twentieth century agricultural and mining development resulted in large scale habitat loss and degradation. As a result, the floodplain's water table has dropped, reducing the growth and regeneration of the riparian forest (Water Forum 2005). Urbanization throughout the greater Sacramento area has replaced agricultural land uses, resulting in an increase in urban runoff (SWRI 2001).

Figure 1-4. Nimbus Dam and Lake Natoma.

1.1.2 Existing Operations

While Reclamation is responsible for daily operation of the dam, USACE's Sacramento District is responsible for developing and prescribing flood risk management operations for Folsom Dam and Reservoir. The dam's Water Control Manual (WCM), which includes the Water Control Diagram (WCD) and Emergency Spillway Release Diagram (ESRD), is the document that stipulates the flood risk management operations of the dam and reservoir. The WCD and ESRD are graphical representations of the operating rules under normal and emergency (dam safety) flood conditions, respectively. The WCD specifies the storage and release functions of the reservoir with a guide curve and other regulating criteria, while the ESRD governs releases required to protect the integrity of the dam structure during rare events.

USACE's authorized flood storage space at Folsom Reservoir continues to be fixed at 400,000 af. Prior to 1995, USACE prescribed flood risk management operations of Folsom Dam using the WCD dated 1986. This WCD also used a basin "wetness" parameter in the determination of when and to what extent the spring refill could begin. This parameter was generally based on accumulated precipitation within the basin. USACE currently prescribes flood operations based on the 1986 WCD.

However, in 1995 Reclamation and SAFCA entered into an Interim Agreement to provide variable flood storage space in Folsom Lake. This agreement included use of a variable space WCD developed by the two agencies in 1993. This WCD "credits" up to 200,000 af of incidental flood storage space in the upper basin at French Meadows, Hell Hole, and Union Valley Reservoirs in determining how much flood space is needed at Folsom Lake. With this WCD, flood storage space at Folsom Lake varies from 400,000 to 670,000 af depending on the amount of incidental flood storage available in the upstream reservoirs.

The Interim Agreement did not include modifying the ESRD in USACE's 1986 WCM. The 1986 ESRD was designed with maximum dam discharge limitations of 115,000 cfs and 160,000 cfs, corresponding to a normal objective release and an emergency objective release, respectively. The ESRD, while defined over a maximum water surface elevation of 3 feet below top of dam, is insufficient to pass the PMF event without encroaching above this elevation, due to limitation on spillway release capacity. Limitations are related to lake elevations relative to elevation of the current spillway.

Updated in 2004, the current Interim Agreement to continue the variable operation extends through 2018, or until construction of the JFP is completed and USACE implements the updated WCM and new WCD and ESRD. The current WCD for Folsom Dam and Lake is shown in Figure 1-5.

Folsom Dam Release Capacities and Lower American River Flow Regulation

Flows in the lower American River are regulated by releases from Folsom Dam and Reservoir. Reservoir releases are restricted by both the capacity of the discharge structures and regulatory limits on the increases in release rates. The maximum capacity of the Dam outlets is 34,000 cfs (8,000 cfs total capacity through the three power penstocks and 26,000 cfs maximum total capacity through the eight gated river outlets).

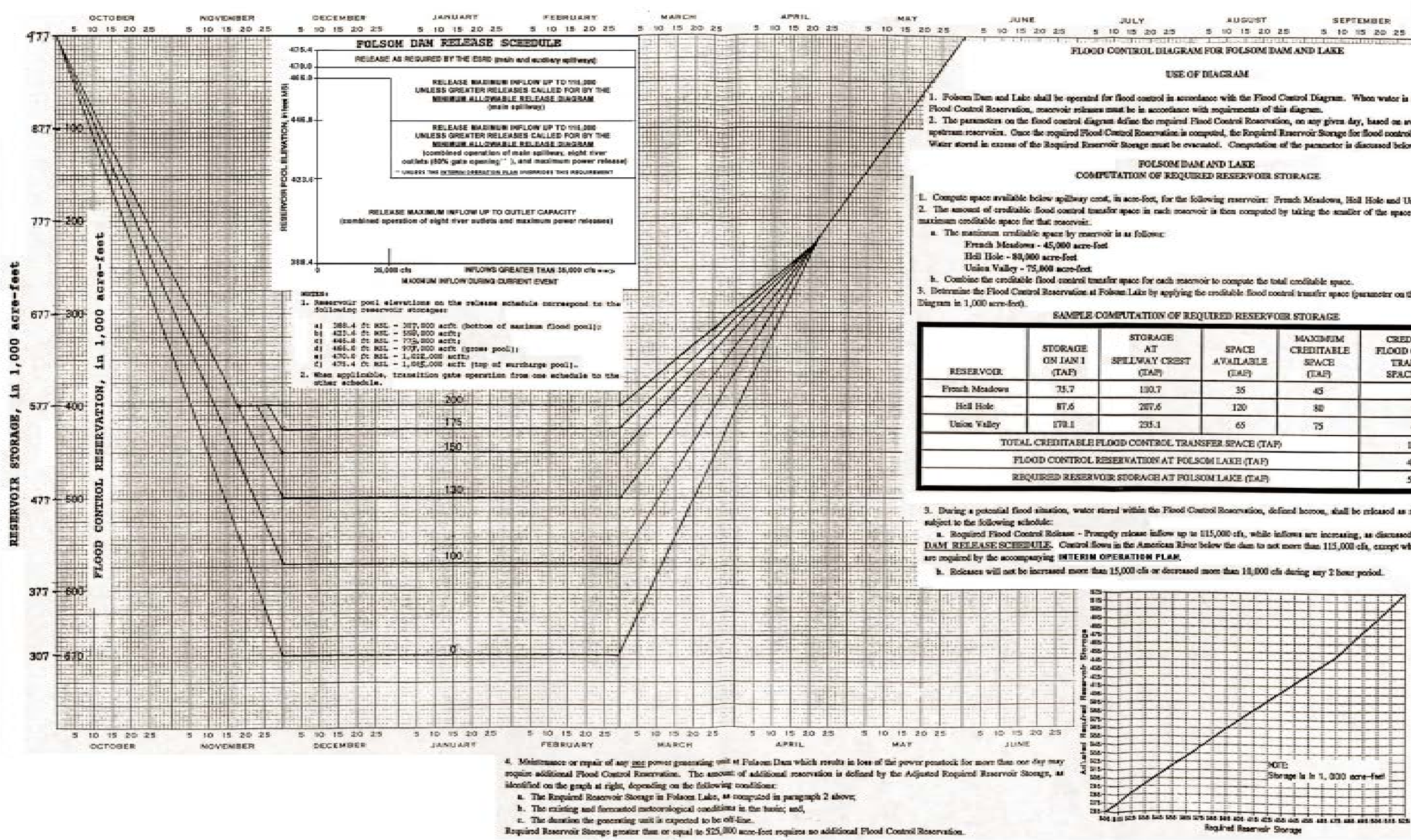


Figure 1-5. Current Reclamation/SAFCA Interim Agreement Folsom Dam and Lake Water Control Diagram.

During a flood event, releases are made through the Dam outlets until water levels in the reservoir reach the spillway crest and releases can be made from the main spillway gates. Once water is above the spillway crest, releases can then be raised incrementally up to a maximum of 115,000 cfs, depending on the Reservoir elevation. The 115,000 cfs represents the authorized design release of the lower American River. The maximum rate of increase in flows is limited to 15,000 cfs per hour until outflow reaches 115,000 cfs. As the Reservoir elevation increases, more water can be released from the spillway gates. A maximum of 160,000 cfs can be released on a limited emergency basis to protect the dam and still remain within the lower American River floodway. The three emergency spillway gates provide additional release capacity but are rarely used. This restriction makes the emergency gates unusable for normal flood management purposes and limits the use of the gates to dam safety outflows.

The JFP completed construction in 2017. However, for the purposes of defining this resource's baseline condition, the WCM has not yet been updated and there will be no formal new rules governing the operation of the JFP facility. Also, there is no environmental document that identifies how this spillway would be operated in place independent of the WCM which dictates the operational parameters. For that reason, the existing conditions assume that the JFP cannot be operated for additional flood risk management purposes. Without an updated WCM, there is the potential that Reclamation may use the JFP in an emergency situation for dam safety purposes, but this would be the extent of the additional capabilities the JFP would provide for this without project condition.

Hydropower - Folsom Dam and Reservoir

Water from the dam is released through three 15.5 foot-diameter penstocks (i.e., pipelines) to three generating units with a total generating capacity of 207 megawatts (MW). By design, the facility is operated as a peaking facility. Peaking plants schedule the daily water release volume during the peak electrical demand hours to maximize generation at the time of greatest need. At other hours during the day, there may be no release (and no power generation) from the plant.

The facility is dedicated first to meeting the requirements of the CVP facilities and preferred customers. The remaining electricity from the plant is marketed to various customers in Northern California. On average, the power plant produces about 10 percent of the power used in Sacramento each year, and about 0.3 percent of the total projected power generation in the State. It also supplies power to the local pumping plant to provide domestic water supply to the Cities of Folsom and Roseville, Folsom State Prison, and San Juan Water District.

Hydropower - Nimbus Dam and Reservoir

Nimbus Powerplant is located on the right abutment of Nimbus Dam, on the north side of the river. To avoid fluctuations in flow in the lower American River, Nimbus Dam and Reservoir is operated as a regulating facility. While the water surface elevation in Nimbus Reservoir fluctuates, water releases to the lower American River are kept constant. The Nimbus Powerplant consists of two generating units, with a generating capacity of approximately 13 MW and release capacity of approximately 5,100 cfs. Water is supplied to two 9,400 horsepower turbines that drive the generators through six 46.5-foot-long by 13.75-foot by 15.95-foot penstocks. Electric generation from this facility is continuous throughout the day.

1.1.3 Previous Environmental Documents

Several environmental documents have been completed related to the operation of Folsom Dam and Reservoir for flood risk management and other purposes in the Sacramento Metropolitan Area. The documents listed below provide pertinent relational information associated with actions leading to the Manual Update. Specific resources areas at a local or regional project area, and not the entire document, are incorporated by reference for the environmental setting conditions. Incorporation of previous analysis by reference is encouraged by NEPA. For NEPA, the CEQ regulations (40 C.F.R. §§ 1500.4, 1502.21) state that agencies shall incorporate material by reference when the effect will be to reduce bulk without impeding agency and public review of the project alternatives. The incorporated material shall be cited, and its content summarized. No material may be incorporated by reference unless it is reasonably available for inspection by potentially interested persons within the time allowed for comment. Material based on proprietary data, which are themselves not available for review and comment, shall not be incorporated by reference. These documents are available for viewing at:

- U.S. Bureau of Reclamation. 2016. Coordinated Long Term Operation of the Central Valley Project and State Water Project. Final Environmental Impact Statement (EIS)-Record of Decision (ROD).
- https://www.usbr.gov/mp/nepa/nepa_projdetails.cfm?Project_ID=21883
- U.S. Army Corps of Engineers. 2015. American River Watershed Common Features General Reevaluation Report. Final EIS/ Final Environmental Impact Report (EIR). http://www.spk.usace.army.mil/Portals/12/documents/civil_works/CommonFeatures/ARCF_GRR_Final_EIS-EIR_Jan2016.pdf
- California Department of Parks and Recreation and U.S. Bureau of Reclamation. 2010. Folsom Lake State Recreation Area & Folsom Powerhouse State Historic Park General Plan/Resource Management Plan EIR/EIS Volumes I and II.
- https://www.parks.ca.gov/pages/21299/files/FLSRA_GP_RMP_Vol1_Final_Plan.pdf
- http://www.parks.ca.gov/pages/21299/files/FLSRA_GP_RMP_Vol2_EIR_EIS.pdf
- https://www.usbr.gov/mp/nepa/nepa_projdetails.cfm?Project_ID=543
- U.S. Bureau of Reclamation and Central Valley Flood Protection Board. 2007. Folsom Dam Safety and Flood Damage Reduction. Final EIS/EIR.
- http://www.usbr.gov/mp/nepa/nepa_projdetails.cfm?Project_ID=1808
- U.S. Bureau of Reclamation. 2006. American River Division Long Term Contract Renewal EIS-ROD.
- https://www.usbr.gov/mp/nepa/nepa_projdetails.cfm?Project_ID=13

- U.S. Bureau of Reclamation and Sacramento Area Flood Control Agency. 2004. Long-Term Reoperation of Folsom Dam and Reservoir. Final Environmental Assessment (EA). Available at Sacramento Public Library, Central Library.
- Sacramento Area Flood Control Agency and U.S. Bureau of Reclamation. 1994. Interim Reoperation of Folsom Dam and Reservoir. Final EIR/EA. Available at Sacramento Public Library, Central Library.

1.2 Purpose and Need for the Water Control Manual Update

The purpose of the proposed action is to reduce flood risk and improve dam safety in the Sac Metro Area. The floods of 1986 and 1997 identified a need for increased Sacramento Metro Area flood protection. Outflows from Folsom Dam, together with high flows in the Sacramento River, caused the river stages to exceed the designed safety margin of the levees protecting the Sacramento area. If the storms had lasted much longer, major sections of the levees would likely have failed, causing probable loss of human life and billions of dollars in damages.

1.2.1 Goal and Objectives

The goal of the Manual Update is to implement operational changes to fully realize the flood risk management and dam safety benefits of the new auxiliary spillway in coordination with Reclamation, CVFPB, the California Department of Water Resources (DWR), and SAFCA. The new set of reservoir operation rules will be developed to meet, at a minimum, the following five primary dam safety and flood risk management objectives:

- Pass the PMF while maintaining at least 3 feet of freeboard below the top of dam to stay within the dam safety constraints of Reclamation.
- Control a 1/100 annual chance event (“100-year flood”) to the normal objective release of 115,000 cfs as criteria set by SAFCA to support FEMA levee accreditation along the American River.
- Control a 1/200 annual chance event (“200-year flood”) as defined by criteria set by DWR to a maximum release of 160,000 cfs.
- Reduce the variable space allocation from the current operating range of 400,000-670,000 af to 400,000-600,000 af as directed in WRDA 99 authorizing language.
- Incorporate improved forecasting capabilities from the National Weather Service (NWS).

To the extent possible, the Manual Update will conform with the other authorized purposes and operational criteria for Folsom Dam and Reservoir, including water supply, water quality, fish and wildlife preservation, hydropower, and recreation. The Manual Update will also consider the effects of the update on the overall water system, including the CVP and SWP.

1.3 Related Authorities

1.3.1 Water Resources Development Act of 1999

The Water Resources Development Act of 1999, Public Law (P.L.) 106-53, § 101(a) (6), 113 Stat. 269, 274-75 (1999) (WRDA 1999), authorized USACE's Folsom Dam Modification Project in coordination with SAFCA and Reclamation.

1.3.2 Energy and Water Resources Development Appropriation Act of 2002

The Energy and Water Resources Development Appropriation Act of 2002 (EWDA 2002) amended Sec. 209, (a) Section 101(a) (6) (C) of the Water Resources Development Act of 1999, Public Law 106-53, defines cost sharing requirements and limitations between the Secretary of the Interior and SAFCA for the costs of replacement water to make up for any water shortage caused by variable flood control operation during any year at Folsom Dam. EWDA 2002 also amended Section 101(a)(1)(D)(ii) of the Water Resources Development Act of 1996, Public Law 104-303, to conform with the cost sharing requirements established by EWDA 2002 for variable flood control operations at Folsom Dam.

1.3.3 Energy and Water Resources Development Appropriation Act of 2006

Congress, through the Energy and Water Development Appropriations Act of 2006, P.L. 109-103, § 128, 119 Stat. 2247, 2259-60 (2005) (EWDA 2006), directed USACE and Reclamation to collaborate on authorized activities at Folsom Dam to maximize flood damage reduction improvements and address dam safety needs.

1.3.4 Water Resources Development Act of 2007

The EWDA 2006 led to changing the Folsom Dam Modification Project from a proposed enlargement of the river outlets on the dam face, to construction of a new auxiliary spillway which is the flood risk management component of the JFP. Authorization to construct the JFP was provided in WRDA 2007, P.L. 110-114, § 3029, 121 Stat. 1041, 1112-13 (2007) (WRDA 2007).

1.4 Content and Scope of the Joint NEPA/CEQA Document

This SEA/EIR (1) describes the development and features of alternatives; (2) discusses environmental resources in the local project area and regional effects assessment areas; (3) evaluates the direct, indirect, and cumulative effects and significance of the alternatives on these resources; and (4) proposes best management practices and mitigation measures to avoid or reduce any effects to less than significant, where feasible.

This SEA/EIR has been organized in accordance with NEPA and CEQA content requirements for each type of environmental document, as well as by USACE policies and editorial styles. Sections have also been added related to development of the alternatives.

This report is organized into 9 chapters. Chapter 2 summarizes the development of the alternatives, while Chapter 3 describes the alternatives in detail including detailed descriptions of new operational rules for alternative plans including the proposed action. Chapter 4 discusses the resources in the project areas, evaluates the potential effects of the alternatives on those resources, and proposes measures to avoid, minimize, or mitigate/compensate those effects, if possible. Chapter 5 then discusses the other required disclosures, including growth-inducing effects, while Chapter 6 summarizes the project's compliance with Federal, State, and local environmental laws and Executive Orders. Chapter 7 discusses the public involvement efforts from scoping through notices of availability of the final document. Chapters 8 and 9 identify the preparers and references, respectively.

1.5 Decision to Be Made

Following completion of the NEPA and CEQA processes, including signatures on the Finding of No Significant Impact (FONSI) and Notice of Determination (NOD), the updated WCM and Water Control Plan would be authorized for implementation by the USACE Commander, South Pacific Division, and Reclamation's Director of the Mid-Pacific Region.

2.0 DEVELOPMENT OF ALTERNATIVES

2.1 Local Project Area and Regional Effects Assessment Areas

Changes in the operation of Folsom Dam would be expected to affect local environmental resources both at the Folsom Reservoir as well as downstream in and along the lower American River. However, since Folsom Dam is operated as part of the CVP (in conjunction with the SWP), the potential effects of alternative Folsom Dam operations on these regional systems must also be evaluated. As a result, this SEA/EIR includes both a local project area and a regional effects assessment area in the evaluation.

2.1.1 Local Project Area

The local project area for the Manual Update is located in the lower American River Watershed in Placer, El Dorado, and Sacramento Counties (Figure 2-1). The Manual Update project area includes Folsom Dam and Reservoir, Nimbus Dam and Lake Natoma, and the lower American River to its confluence with the Sacramento River approximately 30 miles downstream from Folsom Dam.

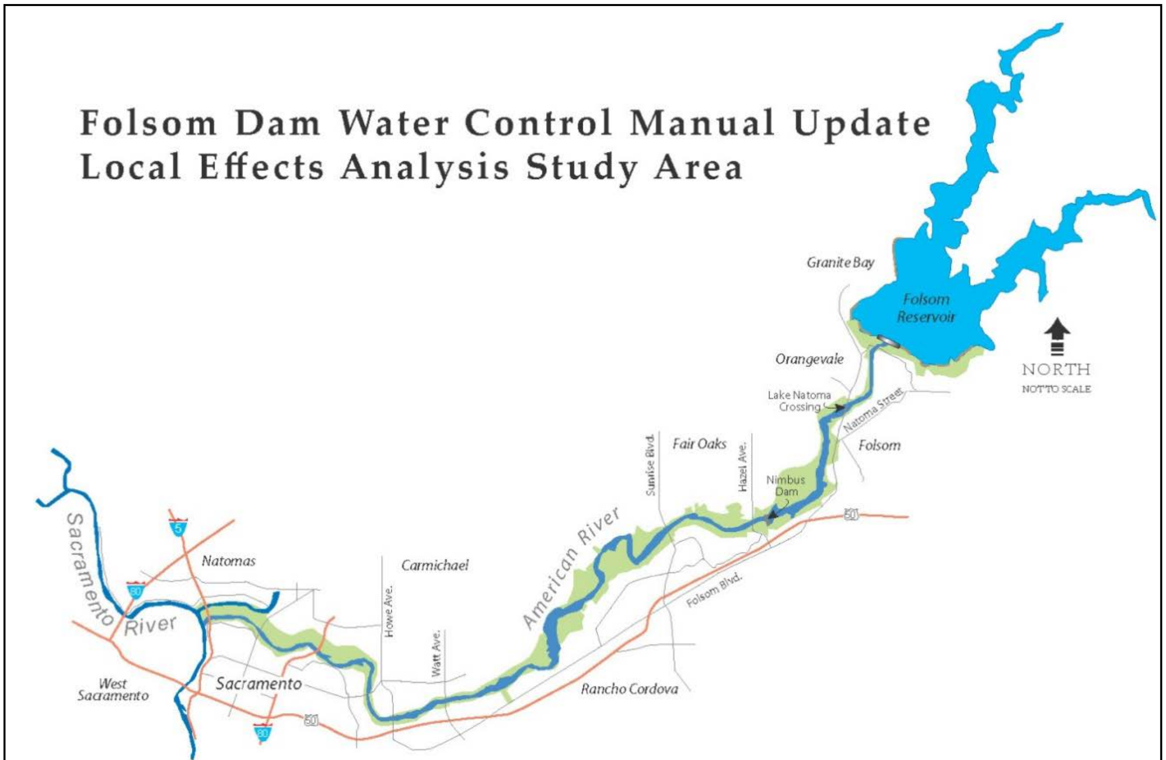


Figure 2-1. Local Project Area.

The American River Watershed covers approximately 2,100 square miles northeast of Sacramento and spans portions of Sacramento, Placer, and El Dorado counties. DWR has delineated five major hydrologic areas within the watershed: the North Fork American, Middle

Fork American, South Fork American, Foothill Drain, and Valley-American areas. The North Fork, Middle Fork, and South Fork are generally grouped into the Upper Basin, while the Foothill Drain and Valley-American areas are grouped into the Lower Basin.

The Upper Basin generates most of the 2.6 million af of average annual inflow into Folsom Lake. The Lower Basin consists of the two smaller hydrologic areas that drain the developed areas of the watershed, including the greater Sacramento area. The Foothill Drain hydrologic area provides additional inflow into Folsom Lake from local runoff, while the Valley-American area primarily drains to the American River below Folsom Lake.

The American River discharges into the Sacramento River at Discovery Park. Flows in the lower American River are largely controlled by Reclamation's operation of Folsom-Nimbus Dams. Though physically much simpler than the Upper Basin system, the Lower Basin system is characterized by more complex operational objectives. Folsom operations integrate flood control, water supply, instream flow requirements, temperature requirements, CVP obligations in the Delta, and hydropower (Reclamation, 2006).

Lake Natoma is downstream of Folsom Dam and serves as an afterbay to Folsom Reservoir. Formed and controlled by Nimbus Dam, the lake is operated to reregulate the daily flow fluctuations created by the Folsom Powerplant. Consequently, surface water elevations in Lake Natoma may fluctuate up to 4.5 feet daily. Lake Natoma has a storage capacity of approximately 9,000 af and a surface area of 500 acres. Nimbus Dam, combined with Folsom Dam, regulates water releases to the lower American River.

The lower American River extends 23 miles from Nimbus Dam to the confluence with the Sacramento River. The upper reaches of the lower American River are unrestricted by levees and are hydrologically controlled by natural bluffs and terraces. Downstream, the river is leveed along its north and south banks for approximately 14 miles from the Sacramento River to the Mayhew drain on the south and to the Carmichael Bluffs on the north.

Throughout the lower American River, the channel and floodway is relatively uniform. The levees are near the channel with minimal batture between them and the river banks. Between Nimbus Dam at River Mile 22 and the upstream end of the levees at River Mile 14, the floodway is between 2,000 feet and 4,500 feet wide. The floodway of the leveed section starting at River Mile 14 is typically less than 1,000 feet wide until River Mile 5 where tailwater imposed by the Sacramento River would occupy floodway space. Here the floodway widens to 2,500 feet to accommodate floodwaters from the American River in a space that is already occupied by the Sacramento River.

The natural bank elevations are formed at a river stage approximately equal to the 5-year flood. In most places, flows under 20,000 cfs remain within the river banks, but there are some locations where the flows can reach 50,000 cfs before rising above the river banks. At about 60,000 cfs the river starts to load the levee toe but the levees wouldn't begin to overtop until about 180,000 cfs, although 160,000 cfs is the current emergency objective release for Folsom Dam.

High runoff volumes in the American River basin occur primarily during the months from October to April, and areis usually most extreme between November and March. From April to July, the wet season is followed by a period of moderately high inflow to the Reservoir from snowmelt. Inflow from snowmelt is either captured by the Reservoir or passed through the Reservoir using controlled release volumes. Flood-producing events are most likely to occur during the October and April months.

There will be no action taken in the American River Basin upstream of Folsom Lake. Although information on the current upstream basin hydrologic condition and forecast information developed from existing gage data and other meteorological data is retrieved from the California Data Exchange Center and National Weather Service (NWS) to inform current operational decisions, no changes to existing operations of upstream reservoirs are proposed as part of this study.

2.1.2 Regional Effects Assessment Area

A full description of the regional effects assessment area is found in Section 1.6 of the 2016 Coordinated Long Term Operation of the Central Valley Project and State Water Project EIS (USBR 2016). The regional effects area generally covers the environment and CVP-SWP facilities within the Sacramento River watershed and Delta, and excludes south of the Delta facilities and watershed areas (Figure 2-2).

Trinity Dam and reservoir storage and flow releases were evaluated and there were no operational or other effects to carry forward. The regional area addresses north of Delta storage, flows, and deliveries and Delta conditions, including exports.

2.2 Methodology to Update the Water Control Manual

The updated WCM for Folsom Dam will reflect a new reservoir operation that satisfies flood risk management goals and dam safety requirements. Other project benefits have been evaluated consistent with WRDA 1999. The process to develop and test alternative operations involved a complex process of assumptions, objectives, data development, and iterative modeling efforts using both reservoir and CVP/SWP system models. This section summarizes basic steps in this complex process.

2.2.1 Development of Initial Alternatives

After the goals and objectives were determined, USACE identified the 82-year period of record (1921 – 2003) hydrology for the American River Basin and developed a set of synthetic inflow hydrologies for hypothetical storm events including the 1/100 and 1/200 annual chance flows and the PMF for Folsom Dam. Candidate flood operations identified during the scoping process were developed to govern use of the increased release capacity provided by the new JFP auxiliary spillway and 400,000 to 600,000 af variable flood storage.

Figure 2-2. Regional Effects Assessment Area.

These storage operations included: 1) maintain the existing interim WCD with upstream credit storage operation restricted to 600,000 af (600 TAF) flood space at Folsom; 2) updated WCD with early spring refill and combined crediting of upstream storage and basin wetness; and 3) updated WCD with forecast-based top of conservation (TOC).

These operation rules and hydrologic data were input into HEC-ResSim, a reservoir system simulation program designed by USACE to model hourly operations at one or more reservoirs whose operations are defined by a variety of operational goals and constraints (HEC, 2012). Details of the upstream reservoir considerations in the model can be found in USACE Engineering Report for the Manual Update. The model represents the operating goals and constraints with an original system of rule-based logic that has been specifically developed to represent the decision-making process of reservoir operation.

Running the HEC-ResSim model produced a set of releases and storage volumes for Folsom Dam and Lake for each hypothetical storm event. USACE then evaluated whether each flood operation rule developed met the flood risk management objectives identified in Section 1.3.1. If a set of flood operation rules met the objectives, then that set was considered further. If not, then the set of rules was refined and the model rerun until the primary objectives were met. This iterative process was repeated until a range of “viable” operation rule sets for Folsom Dam were identified.

HEC-ResSim model outputs were used to model downstream lower American River aggradation and degradation rates using the HEC-6T model. HEC-6T is a one-dimensional (1-d) model that computes aggradation and degradation of the streambed profile over the course of hydrologic events. The Manual Update model was developed from an existing HEC-6T model and updated to include new 3D stratigraphic mapping and erosion testing of erosion resistant material present in portions of the channel.

2.2.2 Refinement of Initial Alternatives

The Folsom Dam flood operation rules for those initial rule sets meeting the primary flood risk management objectives were then input into the CalSim II system model. Developed by Reclamation and DWR, this planning model simulates the statutory, legislative, and regulatory constraints in operating the CVP/SWP. Since use of the model is widely accepted by water purveyors, water rights owners, and contract holders, CalSim II is the system model that is used for most interregional and statewide analyses of CVP/SWP water allocations in California. This model was used to evaluate the local and regional effects of alternatives on resources analyzed in Section 4.

In coordination with Reclamation and DWR, USACE first defined the baseline conditions for the CVP/SWP as mandated by the various constraints on operation of the system. Then each future with-project rule set was represented in CalSim II by applying the guide curve from the rule set that also represents any associated storage crediting mechanism. The 82-year period of record hydrology developed by Reclamation and DWR represents hydrologic input into the CVP/SWP system is then run through CalSim II to generate a with-project model output. This output was then used to compare water deliveries and storage at key index points in the CVP/SWP system, as well as system flows and Delta Water quality, against the previously defined baseline model outputs. The rule sets showing minimal deviation from the baseline model outputs for the CVP/SWP were considered further. Results that showed major deviations were refined closer to meet the previously stated objectives without causing major impacts to the regional effects area.

The output from CalSimII models were then used in other more specific resource models to determine the effects of each rule set on other environmental resources potentially affected by changes in operation at Folsom Dam. Based on model output, refinements were made to the rule sets, and models were rerun to first try and avoid any adverse deviations from the baseline, while still meeting the primary objectives. When avoidance was not possible, then refinements were made to the rule set to reduce the adverse effects to the extent possible, while still meeting the primary objectives identified in Section 1.0. This iterative process was repeated until a range of rule sets was identified that were potentially acceptable to the responsible agencies and stakeholders.

As discussed in Section 4.1.7, significance criteria for each environmental resource were developed by USACE, Reclamation, and DWR per NEPA and CEQA to assist in the identification of the final alternatives, including the preferred alternative. Based on these criteria, the significance of differences between with and without the rule set were considered, and acceptable trade-offs were discussed by the responsible agencies. Finally, those rule sets that met the three primary flood risk management objectives for Folsom Dam, minimized any adverse effects to the extent possible, and best optimized the effects on the regional CVP/SWP system, were brought forward for further consideration. These alternatives, plus a No Action/No Project alternative as required by NEPA and CEQA, are described in Chapter 3.0.

3.0 DESCRIPTION OF FINAL ALTERNATIVES

Following refinement of initial alternatives there were two action alternatives carried forward for further consideration:

- Alternative 1 – Basin Wetness Parameters with Variable Folsom Flood Control Space (400,000 af to 600,000 af) (J602P3): uses information about creditable upstream space and basin wetness, provided by the National Weather Service's California-Nevada River Forecast Center (CNRFC), to compute the required flood control space at Folsom. The credit from each source is computed, summed, and then added to the minimum TOC storage value for that day. The TOC value is the lowest water surface elevation needed for flood storage in the lake for that day. The adopted TOC value is the lesser of the computed and maximum TOC storage values.
- Alternative 2 – Forecast Informed Operations with Variable Folsom Flood Control Space (400,000 af to 600,000 af) (J602F3): the forecast-informed operations alternative is described in detail in Section 3.1.2.

Each action alternative incorporates both the additional release capacity provided by the JFP spillway and variable winter flood space of 400,000 to 600,000 af. The basin wetness alternative (Alternative 1) and the forecast informed alternative (Alternative 2) also incorporated an earlier spring-refill curve, intended to allow earlier storing of additional water during wet years for use in the spring and summer. The revised diagram was tested, using scaled seasonal events and seasonal PMFs, to ensure flood protection and dam safety goals are met.

During preliminary modeling, although Alternative 1 did meet the study objectives, the forecast-informed operation (Alternative 2) showed that it could route a larger event at 160,000 cfs than the other alternatives, as shown in Figure 3-1. In addition, Alternative 2 allows conservation storage at the end of a storm event to remain at the upper end of the variable space storage as shown in Figure 3-2, whereas the other two alternative operations require more of the variable space for flood storage because of the wetness of the upper basin and the lack of creditable flood storage in the upstream reservoirs. This, coupled with additional water storage resulting from the revised spring refill curve, represents an important incidental benefit from Alternative 2 to water conservation efforts for the region.

Due to its ability to route larger events at the objective release targets and the greater efficiency in which it balances flood storage and water storage purposes, Alternative 2 – Forecast Informed Operations with Variable Folsom Flood Control Space (400,000 af to 600,000 af), was identified as the tentatively selected plan and, along with the No Action/No Project Alternative, was analyzed in detail for their affects to the human environment.

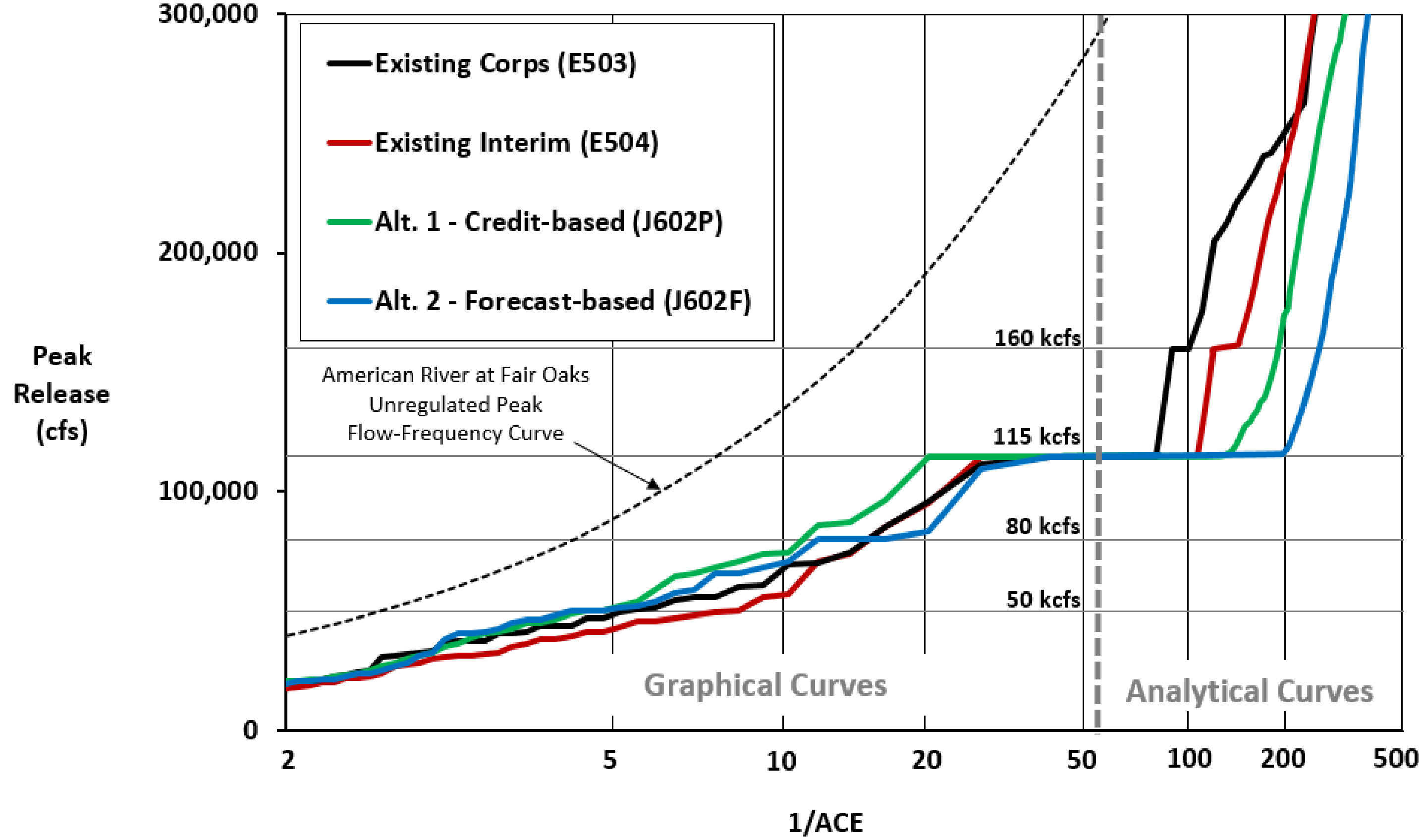
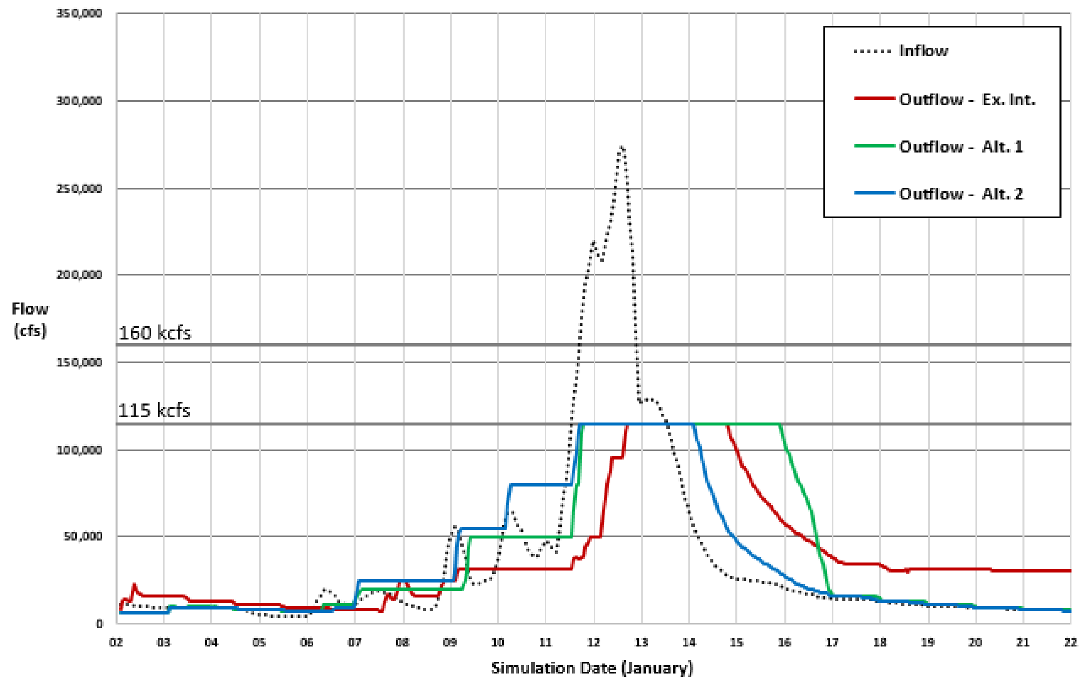


Figure 3-1. Lower American River Flow Frequency Curves of the Operation Scenarios Modeled for the Manual Update.

Note E504 (existing interim) is the No Action/No Project, J602P3 is Alternative 1 – Basin-wetness Operations, J602F3 is Alternative 2 – Forecast-informed Operations, and E503 is the existing USACE 400,000 af fixed flood storage operation. The existing USACE (E503) curve reflects only the 1986 event pattern hypothetical events. Four hypothetical event patterns (1956, 1964, 1986, and 1997) are reflected in the E504, J602P, and J602F curves.



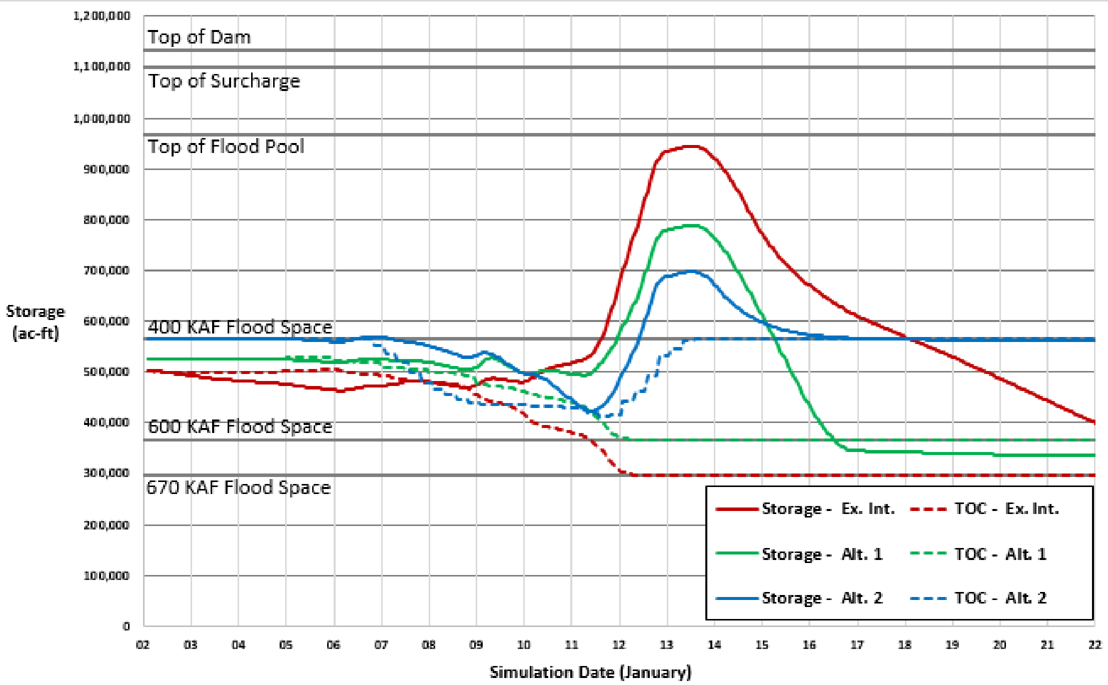


Figure 3-2. Scaled 1-in-100 annual exceedance probability event pattern of the 1997 storm event depicting releases/flows from (top) and flood storage volumes in (bottom) Folsom Reservoir throughout the event.

Note: E504 is the No Action/No Project, J602P3 is Alternative 1 – Basin-wetness Operations, and J602F3 is Alternative 2 – Forecast-informed Operations

3.1 Alternatives Carried Forward for Detailed Analysis

3.1.1 No Action/No Project Alternative

Both NEPA and CEQA require that a No Action/No Project Alternative be described and evaluated in environmental compliance documents including this SEA/EIR. For the Manual Update, the No Action/No Project alternative assumes the same conditions as the future without-project conditions described below including implementation of American Rivers Common Features General Reevaluation Report (ARCF GRR) preferred alternative for erosion control.

Interim Operation of Folsom Dam

Reclamation has indicated that they would operate to the current SAFCA interim agreement in the absence of an updated WCM. Without an updated WCM, Reclamation has also indicated that they would operate the JFP, if necessary, in the extremely rare event where the structural integrity of the dam was at risk of failure. The Reclamation Safety of Dams Act, as amended (P.L. 95-578), authorizes the agency to "construct, restore, operate**,** and maintain new or modified features at existing Federal reclamation dams for safety of dams purposes." Reclamation would proceed with such action only after coordinating fully with USACE, CVFPB, SAFCA, and other cooperating agencies of the Federal-State Flood Operations Center in Sacramento. For purposes of this analysis, for the No Action/No Project condition the four essential elements to be retained under the 2004 Interim Agreement are explained below.

<u>Release Schedule</u>

The water stored in the designated flood control space in the reservoir must be released as rapidly as possible. As a result, the release schedule permits simultaneous use of the five main spillway bays and the eight river outlets at the dam. The maximum specified (objective) release is 115,000 cfs. However, during relatively small flood events, the outflow is limited to the maximum inflow. Any change in outflows is limited to 15,000 cfs per 2-hour period when inflows are increasing, and 10,000 cfs per 2-hour period when inflows are decreasing. When the spillway gates and river outlets are operating simultaneously (between elevation 423.6 feet mean sea level (msl) and 447 feet msl), the gates on the river outlets are set in a 60 percent open position to avoid cavitation damage to the spillway and outlet conduits.

<u>Reservoir Storage Schedule</u>

The water conservation pool must be reduced to no more than 577,000 af (400,000 af empty) at the beginning of each flood season if the three upstream reservoirs (French Meadows, Hell Hole, and Union Valley) have 200,000 af or more empty space at that time. This target must be met by November 17 and maintained unless, based on a daily evaluation, the storage space upstream falls below 200,000 af. At that point, the Folsom Reservoir pool must be reduced in accordance with the storage schedule. For example, a decline to 175,000 af of empty space in the three upstream reservoirs requires a reduction in storage in Folsom Reservoir to 552,000 af, while a decline to 130,000 af of empty space in the three upstream reservoirs requires a reduction in storage in Folsom Reservoir to 477,000 af.

To calculate the total amount of creditable empty space in the upstream reservoirs, French Meadows Reservoir has a maximum of 45,000 af, Hell Hole Reservoir has 80,000 af, and Union Valley Reservoir has 75,000 af of creditable storage. Empty space in excess of these amounts at each of the upstream reservoirs is not creditable.

Adjusted Reservoir Storage Schedule

If one or more of Folsom Dam's power penstocks is lost for more than 1 day, the reservoir storage schedule must be modified to provide additional flood control reservation in accordance with the adjusted reservoir storage schedule shown in the right hand corner of the WCD (Figure 1-5). For example, under this adjusted schedule, when the Folsom Reservoir pool is 425,000 af, a single power penstock outage would require that the pool must be reduced to 395,000 af.

Contractual Commitments

Pursuant to 1999 WRDA, as amended, the Interim Agreement includes the following contractual commitments to avoid potential adverse effects of the operation:

- SAFCA will contribute funds to purchase replacement water if conditions arise which indicate that operating Folsom Dam and Reservoir in accordance with the Interim Agreement causes a water shortfall, which results in significant effects on recreation at Folsom Reservoir.
- SAFCA will compensate the El Dorado Irrigation District (EID) for any incremental increase in pumping costs incurred by EID as a result of the reservoir operation.
- SAFCA will compensate purveyors using the Folsom Pumping Plant for non-CVP water for any incremental increase in pumping costs (i.e., the San Juan Water District and the City of Roseville).
- SAFCA will coordinate with the State of California's Historic Preservation Officer (SHPO) and the U.S. Advisory Council on Historic Preservation (ACHP) to ensure compliance with Section 106 of the National Historic Preservation Act (NHPA).

Related Elements in 2004 Interim Agreement

The Interim Agreement between Reclamation and SAFCA also includes two habitat improvement elements, i.e., reconfiguration of the temperature control shutters and enhancement of the lower American River floodplain habitat. Originally, these elements were contractual commitments to avoid adverse effects of the Interim Agreement's 400,000 to 670,000 af variable flood storage space on aquatic and riparian habitat. However, they became independent elements to address several environmental changes since the 1994 EIR/EA, including the Federal listing of the fall-run Chinook salmon, steelhead, and green sturgeon under the Endangered Species Act.

Interim Temperature Control

This element involves collaboration between SAFCA and Reclamation to design and implement interim improvements to Folsom Dam and/or its auxiliary facilities to improve Reclamation's operational ability to manage the cold water resources in the reservoir and lower American River. Currently, water temperature is managed by using temperature control shutters located at the penstock inlet ports on the dam. The current configuration of the shutters is 3-2-4, with each set bolted together as a unit, see Figure 3-3. This design allows for reservoir water to be drawn into the penstocks from only four distinct elevation ranges, limiting temperature release flexibility.

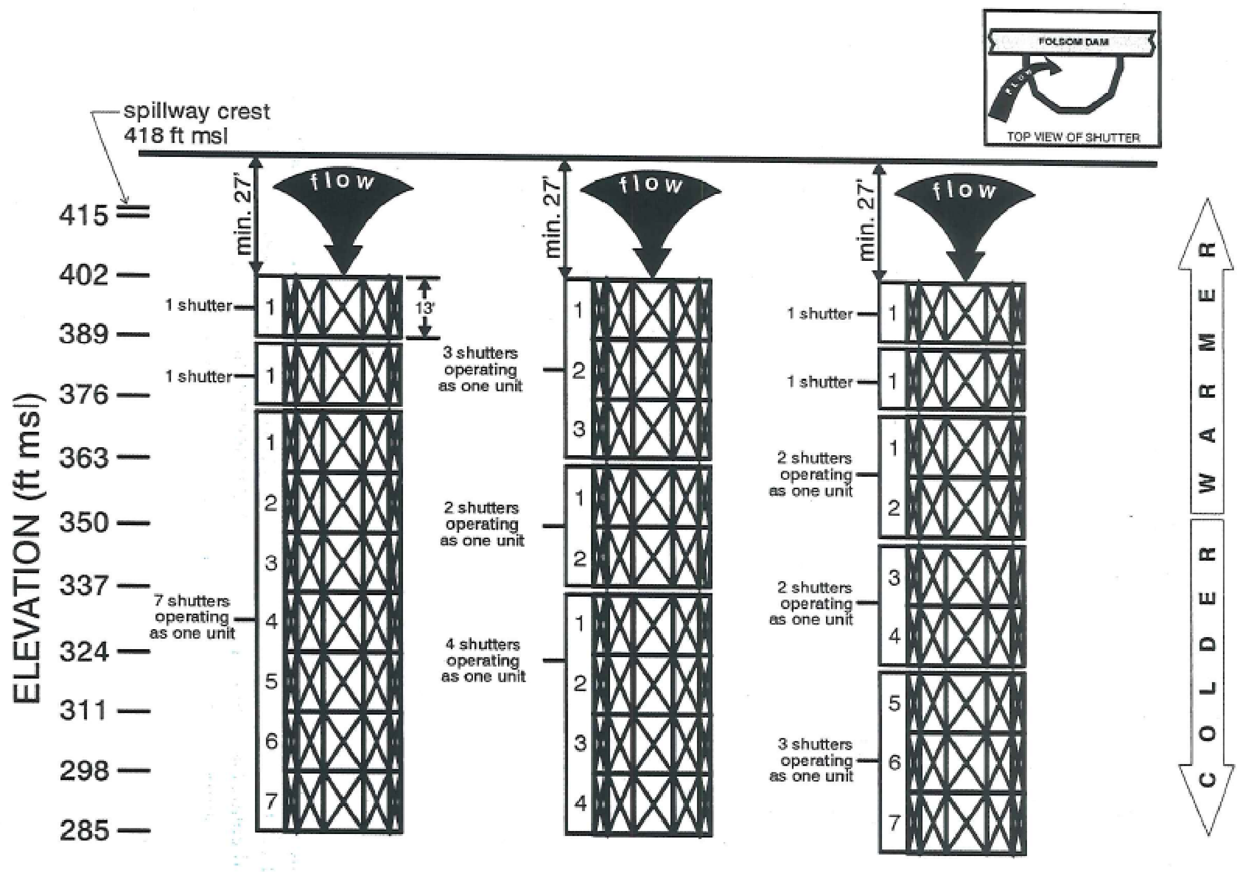


Figure 3-3. Folsom Dam Shutter Configurations.

The Interim Agreement includes two optional designs to allow greater flexibility in managing the temperature of water releases. The first option is reconfiguring the shutters to 1-1-2-2-3. This configuration allows for six different release elevations instead of the current four. The second option is reconfiguring the shutters on only one Folsom Dam penstock to a 7(1)-2 configuration, while leaving the configurations of the two remaining penstocks the same. Based on hydrologic and water temperature modeling, the reconfiguration of one penstock to 7(1)-2 would provide greater operational flexibility and lower American River water temperatures than the 1-1-2-2-3 option, but would be more costly. These improvements would be considered in extreme hydrologic conditions until USACE completes installation of a fully mechanized 7(1)-2 shutter configuration on all three power penstocks as part of the Folsom Dam Raise Project.

Floodplain Habitat Enhancement

The floodplain habitat enhancement committed to in the interim agreement was ultimately constructed at River Mile 0.5. The habitat enhancement included a 3.3 acre graded terrace along the shoreline of the Lower American River that would provide SRA habitat. An additional 5 acres would be used as the transplanting area to receive elderberry shrubs removed from the SRA restoration area. This area would be enhanced with supplemental native plantings to improve its habitat quality. Construction started in 2015 with an estimated completion date of December 2017. This element involved collaboration between SAFCA and Reclamation to design and enhance areas of floodplain habitat along the lower American River corridor to reduce the potential for adverse effects of the interim dam operation on Federally-listed and sensitive fish species, including the fall-run Chinook salmon, steelhead, green sturgeon, and Sacramento splittail. The enhanced floodplain areas are intended to be permanent features.

The primary goals of the enhancement are to establish (1) increased hydraulic connectivity with riverine side-channel habitat and (2) increased inundation of the lower American River floodplain. Reconnecting the river with areas of its historic floodplain would increase inundated riparian habitat during lower flow events, as well as reduce inundated floodplain area that can become isolated from the river channel as flows recede following a high-flow flood event.

This enhancement would benefit these Federally-listed and sensitive fish by providing a longer period of use of inundated riparian habitats during lower flow levels, as well as reducing the potential for fish to become stranded in isolated areas as floodwaters recede. Increased connectivity would reduce this stranding and isolation through the creation of a more "permanent" connection between the main river channel and these floodplain areas, permitting fish to return to the main river channel even when river flows decrease and water levels recede.

Consequences of No Action

Nonoperation of Joint Federal Project

Under No Action/No Project, USACE would not update their latest Folsom Dam WCM (1986). USACE would continue to prescribe flood operations at Folsom Dam based on the 1986 fixed space WCD (400,000 af) and release capabilities provided by the original dam outlets. Under No Action/No Project, Reclamation and SAFCA would extend their Interim Agreement and continue to operate the dam based on their 400,000 af to 670,000 af variable space WCD, utilizing only the original dam outlets.

Although all flood risk management and dam safety features of the JFP would be completed at Folsom Dam, the new auxiliary spillway would not be operated for flood risk management under the No Action/No Project Alternative because a new water control plan was not approved to prescribe its operation and no environmental compliance documents completed to allow for its long-term use. As a result, the flood risk management benefits of the JFP, as well as any benefits of improved forecasting capabilities from the NWS, would not be realized.

However, Reclamation has indicated that they would operate the JFP in the absence of an updated WCM, if necessary, in the extremely rare instance where the structural integrity of the dam structure was at risk of failure.

Compliance with WRDA 1999

Without preparation and implementation of the Manual Update, USACE would not be in compliance with congressional direction in Sections 101(b) and 101(e) of WRDA 1999 as quoted in Section 1.2.1. That is, the variable space allocated to flood control within the reservoir would not be reduced from the current operating range of 400,000–670,000 af to 400,000–600,000 af, and the flood management plan for the American River Watershed would not reflect the operational capabilities of the JFP or improved weather forecasts of the NWS to reduce the flood risk to the Sacramento area.

3.1.2 Alternative 2 – Forecast Informed Operations with Variable Folsom Flood Control Space (400,000 af to 600,000 af).

USACE best practice of operating to "rain on ground" is of limited utility at Folsom for informing flood operations, as this reflects only about the last 8 to 12 hours of precipitation. In other words, excess precipitation on the watershed enters the reservoir quickly, allowing only hours for operational decisions to be made and implemented. Use of forecast information provides potential for extending this time window, or lead time. The current WCM contains general language indicating that forecast information should be considered in the process of making release decisions. Alternative 2-forecast-informed operations formalizes, in operational rules, the required releases which would be made as a result of quantitative inflow forecast information received.

The CNRFC already operates a sophisticated precipitation runoff model of the watershed upstream of Folsom Lake. The model is updated with observed data including measured precipitation, current storage levels at headwater reservoirs, and the current inflow into Folsom Lake. It is further supplied with an ensemble of precipitation forecasts. As such, the resulting CNRFC inflow forecasts already account for the wetness of the watershed *and* upstream storage. The resulting forecast products do not require further processing or application of analysis-based relations to account for these characteristics.

Alternative 2 relies on forecast information generated by CNRFC, who support the use of this information to guide flood operations at Folsom. In the inflow forecast alternative, this information is used for two purposes: 1) to compute a forecast-based TOC during the portion of the year in which variable flood space is in effect, and 2) if the reservoir is encroached above the forecast-based TOC, to compute the required release. The intended effect of this approach is to initiate releases greater than inflow in advance of the main wave(s) of the event. This operation results in drawdown of the reservoir prior to arrival of the main event, making more space available for routing. The updated WCD and ESRD developed for Alternative 2 is shown in Figure 3-4 and Figure 3-5, respectively.

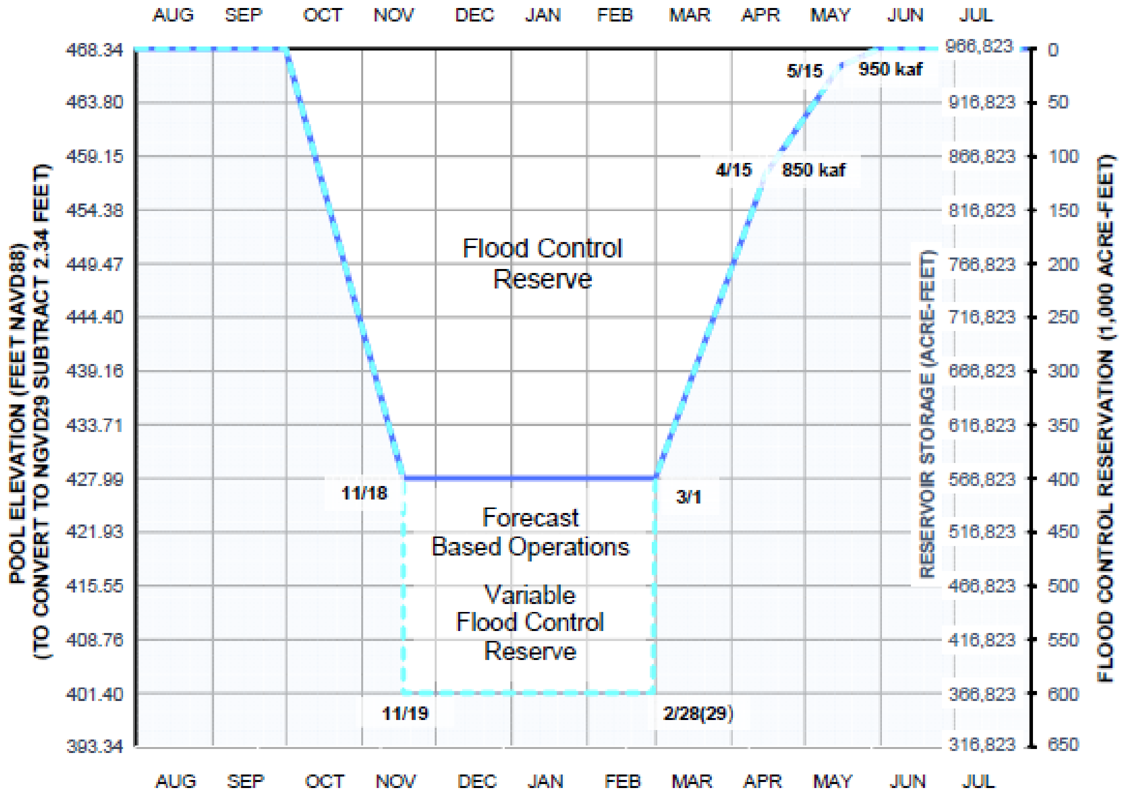


Figure 3-4. Updated Water Control Diagram for Alternative 2.

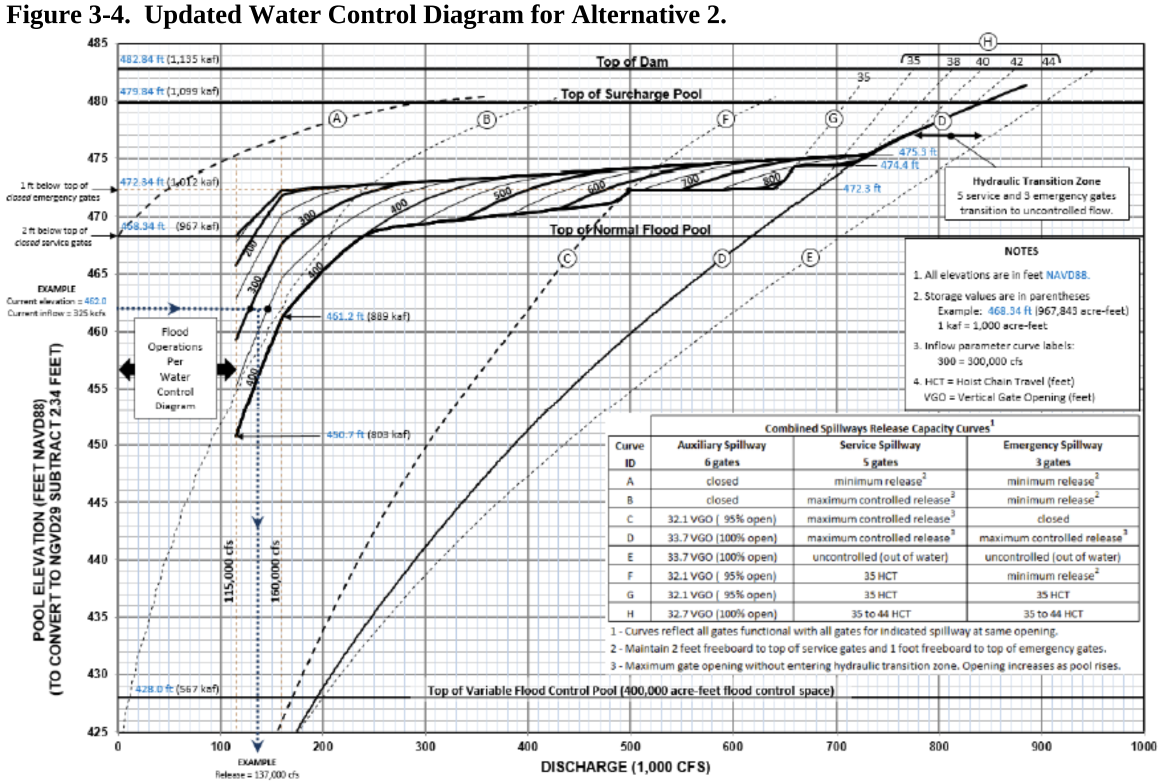


Figure 3-5. Updated Emergency Spillway Release Diagram for Alternative 2.

Alternative 2 achieved the flood performance goal of routing 1/100 and 1/200 AEP events at 115,000 and 160,000 cfs respectively. In addition, updates to the ESRD enable Alternative 2 to successfully route the PMF event with three feet of freeboard. The ESRD shown in Figure 3-5 shows the ESRD the time of analysis. The ESRD has since evolved further, with inflow curves to the left of the 115 kcfs vertical line removed. Removal of these curves does not affect analysis results.

A potential incidental benefit of Alternative 2-forecast informed operations to non-flood operations is that the TOC is effectively allowed to be at the highest level allowed by the WCD, except immediately preceding and during an event. Unlike Alternative 1 that relies on upstream storage credit and/or basin wetness, the TOC returns to the highest allowed level once an event has passed, providing improved opportunity for the reservoir to refill.

Inflow forecasts present unique challenges in developing a reservoir operation scheme. The primary challenge is the simple fact that forecasts are not perfect: forecasted volumes are not exactly the same as the actual inflow volumes. While forecast skill has been improving over the years, and will continue to improve, understanding and accounting for the degree of variability in forecasts is required. A second challenge is given the variability of forecasts, and variability of inflows even if forecasts were perfect, there is a need to make well-behaved (non-erratic) releases. This is an important consideration for dam operations as well as minimizing downstream effects and supporting coordination efforts.

The rules proposed to address the degree of variability in forecasts and the variability of inflows so that effects to dam operations and downstream resources are minimized and are discussed in more detail below.

Forecast-based Top of Conservation

During the period of variable flood space on the WCD, the TOC is computed as a function of forecasted inflow volumes into Folsom Lake. Four forecast durations are considered: 24 hours, 48 hours, 72 hours, and 120 hours (1-, 2-, 3-, and 5-day). The volumes associated with these durations are cumulative, meaning that the 5-day volume includes and will always be greater than the 1-, 2-, and 3-day volumes. Forecast volumes for these durations will be provided by CNRFC during operation, on a 6-hour time step during large events, and more frequently during an event if requested by Reclamation or USACE.

Use of the diagram shown in Figure 3-6 requires the operator to first receive the four forecast volumes, one for each duration, from CNRFC (volumes will be provided in af). For each duration, the forecast volume is located on the x-axis, and the corresponding candidate TOC is located on the y-axis using the indicated relation for that duration. This exercise is completed for each of the four forecast volumes. Finally, the minimum (lowest) candidate TOC values is adopted as the TOC.

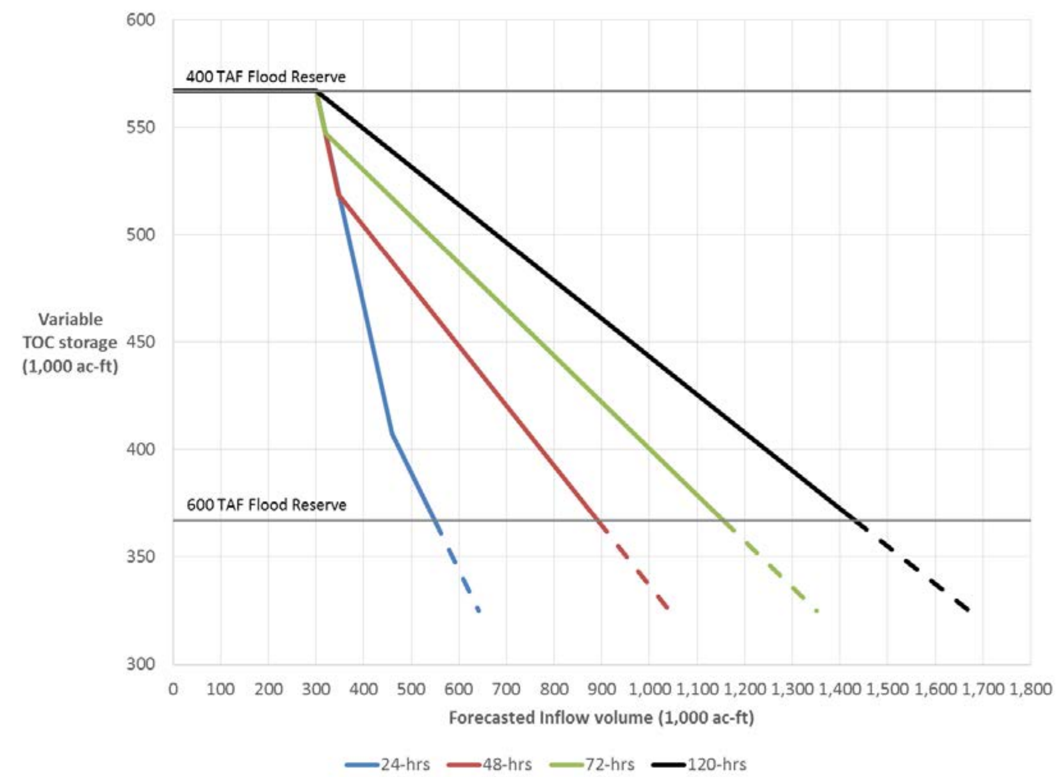


Figure 3-6. Forecast-based Drawdown Relationships.

Forecast-based Releases

Forecast-based releases are made when the TOC drops below the maximum TOC value shown on the water control diagram, and the actual storage is above the TOC. In this condition, the storage is encroached into the flood space, and forecast-based flood releases are required. The proposed approach allows for two modes of operation: non-flood operations and flood operations, the distinction being whether or not the current pool elevation is greater or less than the TOC. The reservoir is in a non-flood (conservation) mode of operation except when a major event is underway. During this time, TOC is at the maximum level defined by the WCD. As an event approaches and forecasts drive the TOC down (forecast volume greater than 300,000 af), the TOC may drop below the storage if the actual storage is sufficiently high. At this point in time the reservoir becomes encroached and switches to a flood operation mode. In this mode, releases are informed based on forecast information as well as actual inflows until the TOC returns to the maximum value on the WCD.

In order for forecast-based releases to be effective, releases greater than inflow must be made prior to the arrival of the main wave of the event. Because of constraints, such as operational delays, ramping rate restrictions, and channel capacity, there is only a limited time window in which effective releases can be made. Therefore it is necessary to start the process of making releases early, relying on longer range forecasts. At Folsom, this means using the 5-day forecast volume as the trigger for initial forecast-based releases.

Stepped releases for Alternative 2 would be made as indicated in Table 3-1. The first column shows the release step targets as they relate to inflow into Folsom Reservoir. As indicated in the second column, from October 1 to November 18 and from March 1 to June 1, releases would follow current inflow, subject to rate of increase constraints. During the period of variable flood reserve, from November 19 to February 28, stepped releases would be made in response to the forecasted inflow volumes. Column three shows that 300 TAF is the threshold volume for all four forecast durations. Once the 5-day volume increases above 300 TAF, the target release is 25,000 cfs. The next release steps of 50,000 cfs and 80,000 cfs are triggered when the 3-day and 2-day volumes exceed 300 TAF respectively. The largest forecast-based release step of 115,000 cfs, the normal objective release, is triggered when the 1-day volume exceeds 300 TAF and the current inflow is at least 115,000 cfs. Releases above 115,000 cfs are governed by the ESRD, and are a function of current pool elevation and current inflow.

Table 3-1. Stepped Release Thresholds for Alternative 2 – Forecast-informed Operations.

Release Steps	Matching Inflow Thresholds (Oct. 1 to Nov. 18 and Mar. 1 to Jun. 1)	Forecast-based Inflow Volume Thresholds (Nov. 19 to Feb. 28)
25,000 cfs	Release maximum event inflow	5-day volume > 300 TAF
50,000 cfs	Release maximum event inflow	3-day volume > 300 TAF
80,000 cfs	Release maximum event inflow	2-day volume > 300 TAF
115,000 cfs	Release maximum event inflow	1-day volume > 300 TAF and current inflow >= 115,000 cfs

The updated water control diagram reflecting the proposed action is shown in Figure 3-7.

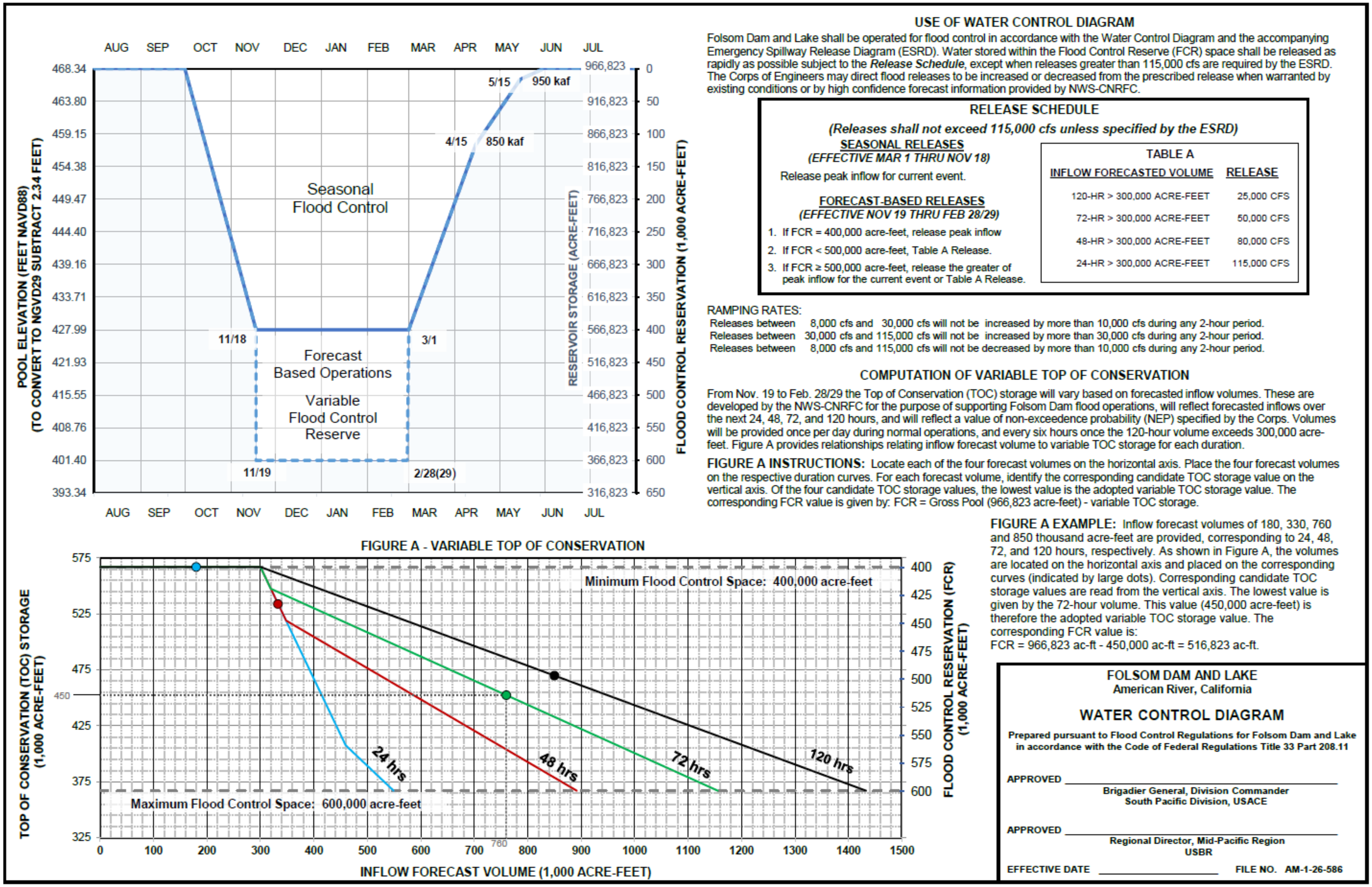


Figure 3-7. Draft Forecast-informed Operation Water Control Diagram.

4.0 AFFECTED ENVIRONMENT, ENVIRONMENTAL CONSEQUENCES, AND MITIGATION

4.1 Introduction

This section describes the environmental setting/affected environment (resources); evaluates the potential effects (and level of significance) of the alternatives on those resources; and proposes avoidance, minimization, and mitigation measures to reduce any effects to less than significant. The discussion is quantitative, when possible, and both direct and indirect effects are considered for the resources in Sections 4.2-4.10. The potential cumulative effects of the alternatives are discussed in Section 5.0.

The description of the affected environment for the resources is based on the information in Reclamation's 2004 Final Environmental Assessment for the Long-term Reoperation of Folsom Dam and Reservoir, the 2007 Final EIS/EIR for the Folsom Dam Safety and Flood Damage Reduction Project, and Section 1.1.3's list of previous environmental documents incorporated by reference. This information has been updated, as appropriate.

4.1.1 Resources Not Evaluated in Detail

Per both NEPA and CEQA, only those environmental resources that have the potential to be affected by one or more of the alternatives need to be evaluated in the SEA/EIR. The determination of these resources for the implementation of the Manual Update was based on the location, type, and features of the update, as well as the significant issues identified by stakeholders, agencies, and/or the public during the scoping process.

The Manual Update would only involve modifying the operations as they relate to flood risk management and dam safety at Folsom Dam. There would be no construction or modification of any of the existing structural features of the dam, reservoir, or associated infrastructure. As a result, this SEA/EIR assumes that there would be negligible to no effects on environmental resources not related to the timing, rate, or volume of flood releases from the dam. These resources include geology; topography; air quality; climate and climate change; traffic and circulation; noise/vibration; hazardous, toxic, and radiological waste; environmental justice; and aesthetics/visual resources.

The resources that could be related to the timing, rate, or volume of flood releases are evaluated in detail in this SEA/EIR and include hydrology, hydraulics, water quality, terrestrial vegetation and wildlife, fish and aquatic resources, special status species, water supply and distribution, hydropower production and distribution, recreation, and cultural resources. This list is also consistent with those resources identified as being of particular concern to stakeholders, agencies, and/or the public during scoping (i.e., erosion and water quality, water supply, power generation, listed and sport fisheries, and recreation).

Climate Change

Per USACE Engineering Circular Bulletin (ECB) 2016-25, USACE planning studies are required to provide a qualitative description of climate change impacts to inland hydrology. The purpose of this section is to meet the requirements as set forth in the ECB. This section will describe how climate change could impact the hydrologic runoff processes in the watersheds in the Sacramento area.

The American River watershed, which flows through Folsom, has many high elevation mountains with peaks ranging from 5,000 to 11,000 feet above sea level. November through March is the period when the most significant and damaging storms hit this region. A significant portion of this watershed is covered in snowpack during the winter months. As temperatures warm during the century, it is expected that the snowpack line (demarcation between bare ground and snowpack covered ground) will recede to higher elevations, and a greater percentage of the drainage area of individual watersheds will incur rainfall, as opposed to snowfall. This trend is expected to cause significant increases in runoff volume in the high elevation watersheds for large storms. Another impact of warmer air temperatures is that the spring snowpack will melt earlier, thus increasing reservoir inflows at a time when spring storms still threaten the region and empty space is still required to attenuate flood inflows. Flood control operations at reservoirs could become more difficult in the spring months. The trend towards earlier spring snowmelt has already been observed in the Sierra Nevada Mountains over the last century.

Simulations with global climatic models are mostly consistent in predicting that future climate change will cause a general increase in air temperatures in California, including during the critical months when most precipitation falls. Projected changes in future climate contain significant uncertainties. Uncertainties exist with respect to understanding and modeling of the earth systems, uncertainties with respect to future development and greenhouse gas emission pathways, and uncertainties with respect to simulating changes at the local scale. Climate models suggest the projected temperature signal is strong and temporally-consistent. All projections are consistent in the direction of the temperature change, but vary in terms of climate sensitivity. Annual precipitation projections are not directionally consistent. Multi-decadal variability complicates period analysis. Estimates project that air temperatures will increase by over three degrees Fahrenheit by the middle of the current century.

Several recent climate change studies by Reclamation, CH2M HILL, NOAA, and other researchers have focused on the Central Valley. In general, these studies found that warming conditions could cause a median sea level rise of 36 inches, and increase the difficulty of conveying water through the Sacramento-San Joaquin Delta. Temperatures would most likely increase by 1.6 degrees to 4.8 degrees Fahrenheit from early to late 21st century. Precipitation may increase in the areas north of the Sacramento-San Joaquin Delta with very little change projected in the Tulare Lake Basin. Overall extreme precipitation is likely to increase. Evapotranspiration is expected to increase with warming temperatures and snowpack would decline with warming temperatures, particularly in the lower elevations of the mountains surrounding California's Central Valley. Warmer winter temperatures and precipitation changes could lead to an increased risk of flooding from large storms (Reclamation 2016; CH2M HILL 2014; NOAA 2013; Das et al. 2013; Levi, 2008; Barnett et al., 2008).

Three USACE modeling tools were used to evaluate climate change effects. The USACE Climate Hydrology Assessment Tool (USACE 2106c) was used to examine observed annual maximum 1- and 3-day streamflow trends at the USGS Gage (11433300) MF American River near Foresthill CA upstream of the Folsom Dam. The tool only has capability to run first order statistics on the 1- and 3-day flows and the Foresthill Gage was chosen because flow is not controlled by a major reservoir upstream. The hydrologic time series for the one day and three day annual maximum flow at the Foresthill gage are shown in Figure 4-1 and Figure 4-2 below. The gage exhibits declining trends in stream flow for both the one day and three day time series. P values of 0.2336 and 0.2820 indicate that these observed trends are not very significant and that there has been little change in the flood risk as measured by the observed record over the last 55 years in the vicinity of this gage.

The non-stationarity detection tool (USACE 2016d) was used to examine the time series data at the Middle Fork of the American River at Foresthill gage. Non-stationarities were not detected in either the one day or the three day time series further confirming that there has been no change in the flood risk for the area in the vicinity of the Foresthill gage.

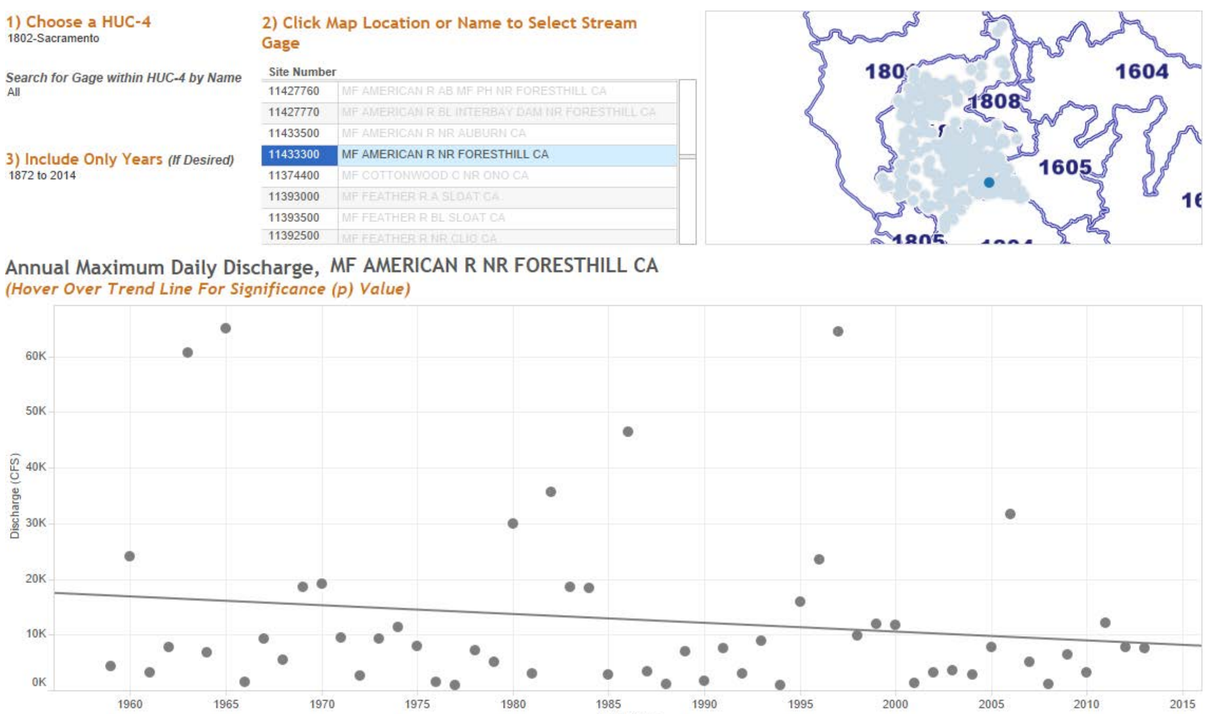


Figure 4-1. Annual Maximum Daily Discharge at Middle Fork of the American River near Foresthill Gage.

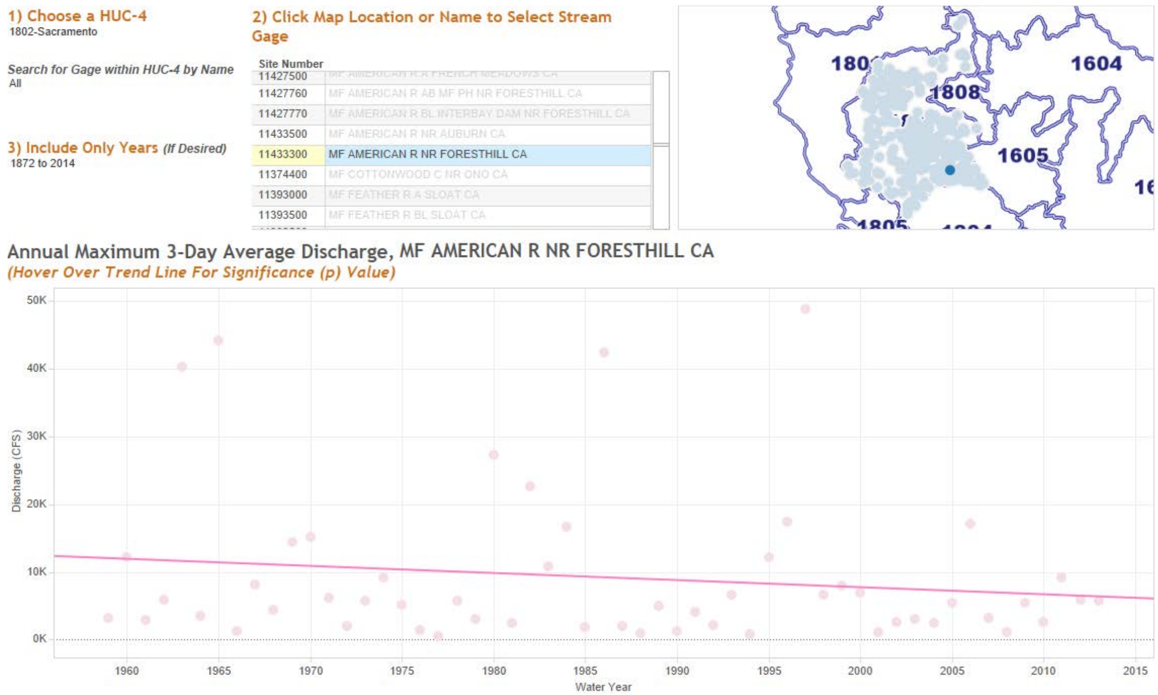


Figure 4-2. Annual Maximum 3-day flow at the Middle Fork of the American River near Foresthill Gage.

The USACE Climate Hydrology Assessment Tool was used to examine observed and projected trends in watershed hydrology to support the qualitative assessment. As expected, there is considerable and consistent spread in the projected annual maximum monthly flows (Figure 4-3). The overall projected trend in mean projected annual maximum monthly flows (Figure 4-4) increases over time and this trend is statistically significant (p-value <0.0001) suggesting that there may be potential for an increase in flood risk in the future relative to the current time. The result is qualitative only.

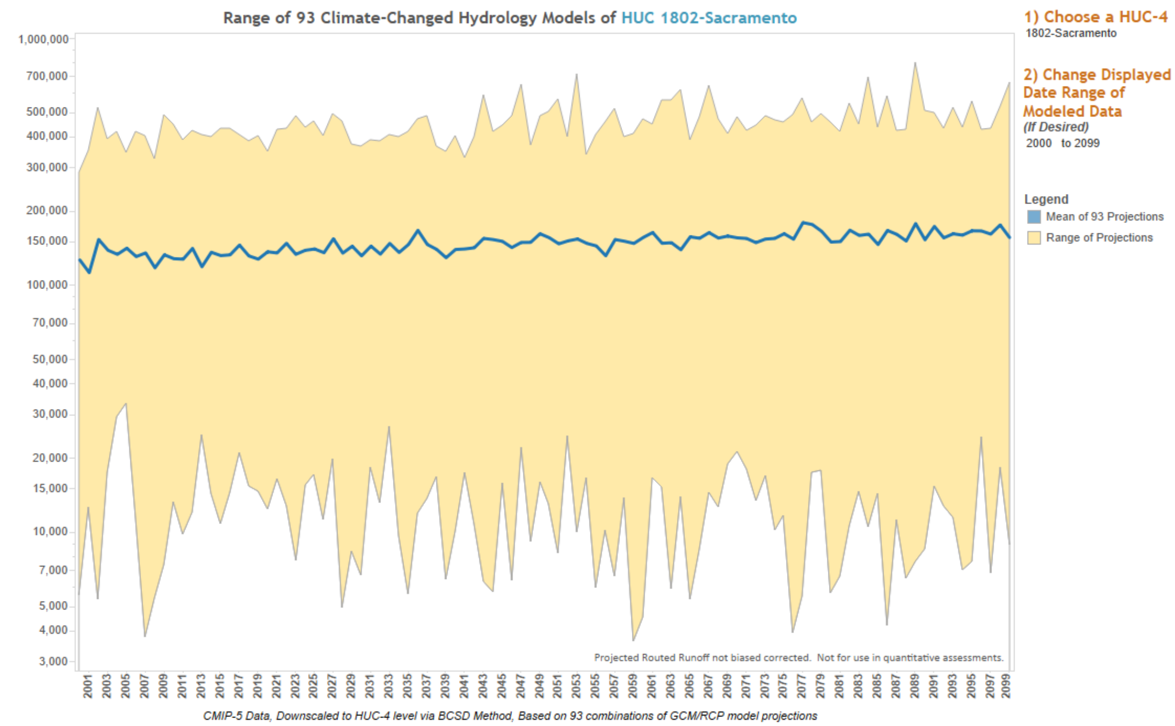


Figure 4-3. Range of 92 Climate Altered Hydrology Model projections of Annual Maximum Monthly Average Flow in HUC 1802-Sacramento.

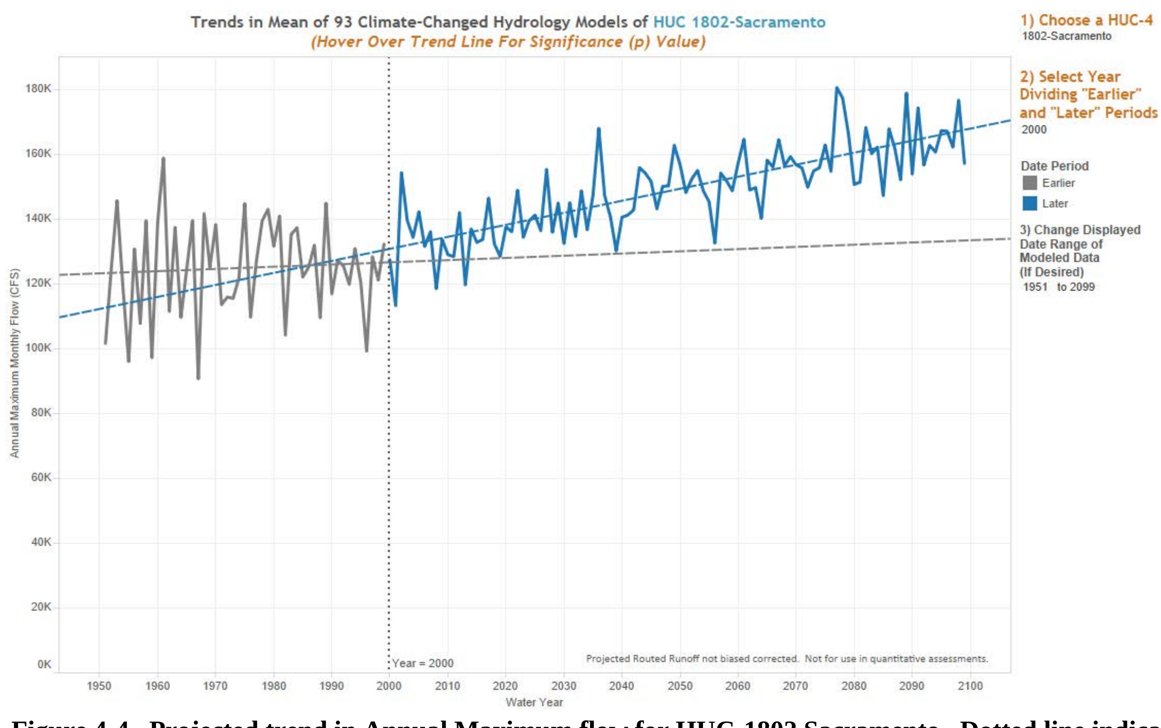


Figure 4-4. Projected trend in Annual Maximum flow for HUC-1802 Sacramento. Dotted line indicates year 2000, gray dashed line indicates present trend from 1950 to 2000 and the blue dashed line indicates projected climate altered trend in streamflow after 2000 to 2100.

The USACE Watershed Vulnerability Assessment Tool (USACE 2106e) was used to examine the vulnerability of the project area to future flood risk (Figure 4-5). For the Sacramento

Watershed (HUC 1802), This tool shows that the area is highly vulnerable to increased flood risk during the 21st century for all wet and dry projected scenarios. Figure 4-5 shows the breakout of indicators for each scenario and epoch combination. In both the wet and dry scenarios, the increase in the area of the 1/500 AEP particularly in urban areas is the dominant risk indicator followed by change in size and timing of flood runoff. This indicates that in the future, floods could increase in magnitude over time and that much of the population and economic activity will be in areas which will be vulnerable to floodwaters (at least the 1/500 AEP year floodplain). Floods could be larger and more damaging than in previous times.

Future consideration and evaluation should occur to determine whether there are any actions that can be taken in the context of the current study to make the community more resilient to higher future flows. Such actions might include flood-proofing or acquiring structures, developing evacuation plans, land-use planning, changes to levees and levee alignment, and adjusting elevation or spacing of mechanical features e.g. pump stations, among other actions.

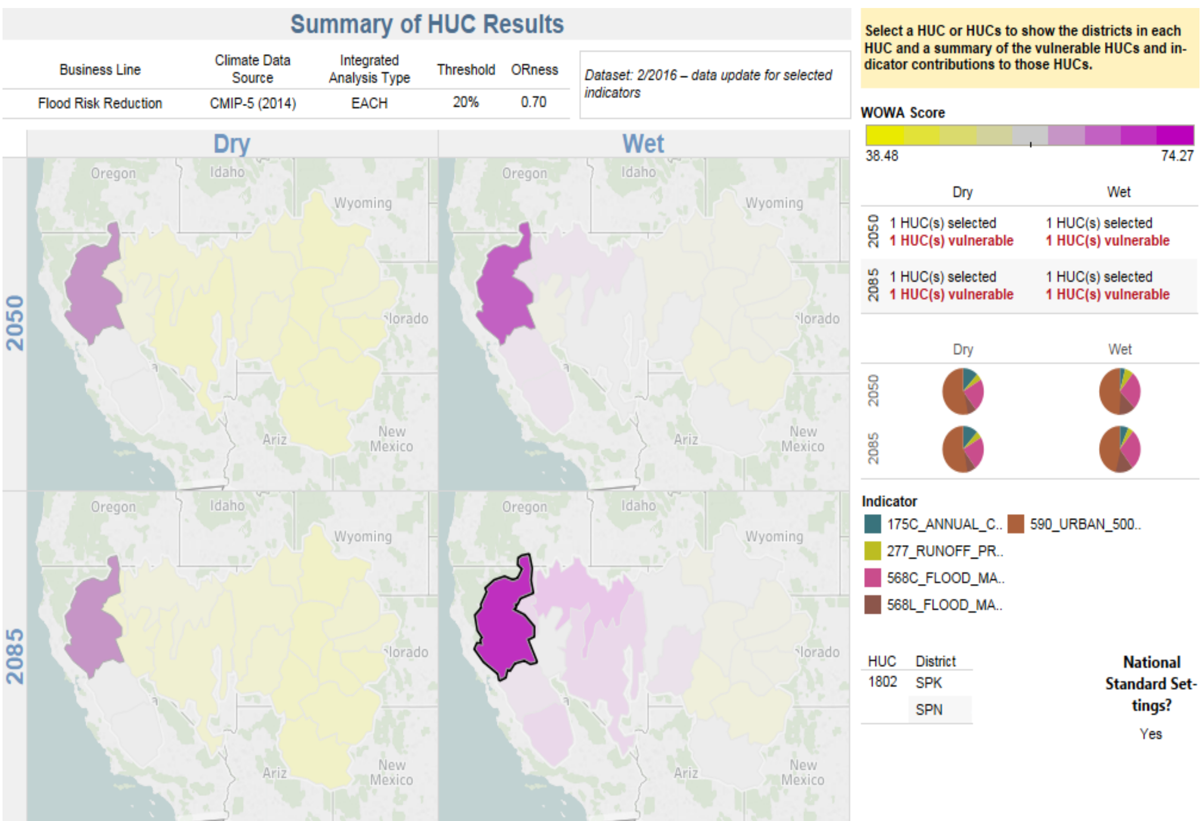


Figure 4-5. Summary of Vulnerability Assessment for HUC 1802 - Sacramento Watershed.

Note: This area is vulnerable to increased flood risk due to increases in the area of the 1/500 AEP floodplain and changes in the magnitude of floods as shown in the pie charts on the right of the figure. The WOWA scores are in the range of 59-67 which indicates a high overall vulnerability.

In conclusion, new climate projections (CMIP5) are now available which are consistent with the most recent Intergovernmental Panel on Climate Change (IPCC) Assessment Report 5 (AR5) (Taylor et al. 2012). Three on-going, DWR-supported, research studies were initiated in 2013 and are expected to be completed in the coming months. These include the *Climate Variability Sensitivity Study* (completed by USACE in 2014) which evaluated the effects of increasing temperature only (not precipitation) on flood runoff on selected watersheds. The other two include the *Atmospheric River Study* (led by Scripps Institute of Oceanography/USGS) investigating indices and future projections of the major flood-producing atmospheric processes, and the *Watershed Sensitivity Study* (led by UC Davis) investigating the atmospheric and watershed conditions that contribute to the extreme flows on several Central Valley Watersheds. Both observations and downscaled climate model outputs indicate that the climate in the Sacramento Valley of California will be warmer and possibly wetter than the present one but the likelihood of large floods will increase due to increases in moisture content of the storms and higher snow levels leading to more precipitation falling as rain and more basin exposure for runoff to occur. Droughts in the regional project area are expected to become more extreme or prolonged, causing water supply concerns.

Climate change operational effects may differ seasonally and across years, and have an effect on the PMF. The WCD has three distinct components defined by the time of year. The fall drawdown period, the winter rainflood season, and the spring refill. The fall drawdown period starts at the end of September and runs through mid-November. This is the period when the storage in the reservoir must be reduced to make room for the increasing potential of floods as the winter flood season approaches. The drawdown curve for No Action/No Project and Alternative 2 – Forecast-informed Operation plan is identical. Therefore, climate change is expected to have similar impacts to without- and with-project conditions at the dam this time of year.

The maximum required flood space occurs in the winter rainflood season which occurs from mid-November to the end of February as defined by the Variable Flood Control Reserve shown on the WCD. From a flood damage reduction perspective, the Alternative 2 – Forecast-informed operation is better adapted to handle future climate change impacts (i.e. more runoff for a given frequency flood) for three reasons: a) the forecast-informed operation is based on real-time forecasts instead of a pre-determined amount of flood space based on inflow frequency curves (i.e. the existing condition rule curve becomes outdated due to climate-induced changes to the hydrologic characteristics of the watershed) b) forecast technology will improve over time and c) the forecast-informed operation takes advantage of the new auxillary spillway gates that allow for larger releases in the early part of a flood event. From a water supply perspective, the Alternative 2 – Forecast-informed variable flood control reserve also allows more flexibility to store water during drier water years, which is beneficial in light of predictions that climate change could increase the severity and length of droughts.

The third portion of the WCD is the spring refill period which runs from 1 March through the end of May. For the Manual Update, the spring refill curve was shifted to the left (as compared to the existing condition) to allow an increase in water supply storage and a corresponding decrease in the required flood control space. An updated seasonal flow frequency analysis and subsequent reservoir modeling of seasonal floods with the new JFP dam configuration indicated that the spring refill curve could be adjusted to allow for increased water supply storage in the spring without compromising the study goal of providing a 0.5-percent annual chance exceedance (ACE) level of protection for the downstream community. Consequently, the Alternative 2 – Forecast-informed operation would provide more water supply benefits in the spring under both today's conditions and in the future when climate change impacts become more evident.

Climate change is expected to cause the spring snowmelt to occur earlier in the spring, which could create some conflict with the need to have flood space available for spring storms. This phenomenon could increase flood risk in the spring. As mentioned above, the spring refill curve was adjusted to allow for increased water supply storage in the spring under the Alternative 2 – Forecast-informed operation plan, and a primary goal of the Alternative 2 – Forecast-informed operation is to pass the PMF while maintaining at least 3 feet of freeboard below the top of dam to stay within the dam safety constraints of Reclamation. This change is somewhat offset by the increased flood damage reduction capabilities of the new auxillary spillway. Because the JFP's auxiliary spillway is 50 feet lower than the main spillway, the dam can make larger releases at lower water surface elevations which improves its ability to handle rare floods. For example, without the JFP, the elevation which the reservoir could nominally make a release of 115,000 cfs was 439 feet (NGVD29) compared to 404 feet (NGVD29) with the JFP.

In situations where the starting water surface is significantly higher than elevation 439 feet (NGVD29) when a spring storm occurs, there is a potential decrease in the level of protection from the existing condition WCD to the Alternative 2 – Forecast-informed WCD. This fact is true regardless of whether climate change occurs or not, although modeling shows the JFP will be able to protect the downstream community from a 0.5-percent ACE event based on the latest seasonal inflow frequency curves produced by this study. Under the new WCM, the top of water supply pool is allowed to exceed elevation 439 feet by mid-March. There is a realization among experts that there is significant uncertainty in the estimated impacts of climate change. This is shown by the large variability in projected outcomes by analysis of many of the world's Global Climatic models and their outputs. Any change is expected to occur incrementally in small steps over the decades. Future monitoring by USACE of inflow frequency trends and continued research on climate change impacts will help our agency identify the potential need to revise the Folsom Dam Water Control Manual in the future.

Greenhouse Gas

The purpose of this section is to meet the requirements as set forth in state or local plans for GHG and in the CEQA Guidelines Section 15064.4. This section will describe the regulatory setting, the methodology for determining GHG emissions, and analyze how GHG emissions and could impact the hydrologic runoff processes in the watersheds in the Sacramento area. These issues were included in modeling runs and specific resource area analyses.

<u>Regulatory Setting</u>

State – On June 1, 2005, Governor Arnold Schwarzenegger issued Executive Order S-3-05 which “established greenhouse gas reduction targets, created the Climate action plan Team, and directed the Secretary of the California Environmental Protection Agency (Cal/EPA) to coordinate efforts with meeting the targets with the heads of other state agencies. The order also requires the Secretary to report back to the Governor and Legislature biannually on progress toward meeting the GHG targets, GHG impacts to California, and Mitigation and Adaptation Plans." (California Climate Change Portal, 2015)

The following year, the Global Warming Solutions Act of 2006, commonly referred to as Assembly Bill 32 (AB 32), required the California Air Resources Board (CARB) to develop regulations and policies to regulate sources of emissions of GHGs that cause global warming. CARB was directed to create a program that would reduce statewide emissions to 1990 levels by 2020, a reduction of approximately 15 % below emissions expected under a "business as usual scenario." (CARB 2017). These reductions were to be met by adopting regulations that maximize feasible technology and are cost effective while improving efficiency in land use sectors (i.e. energy, transportation, waste).

In addition, AB 32 directed CARB to develop a scoping plan to help lay out California's strategy for meeting the goals. This scoping plan was to be updated every 5 years and would be funded through fees collected annually from large emitters of GHGs such as oil refineries, power plants, cement plants, and food processors.

Senate Bill 97 (SB 97) approved by legislature in 2007, was an act relating to the California Environmental Quality Act (CEQA) that addressed GHGs. Specifically, SB 97 required Office of Planning and Research to prepare and develop proposed guidelines addressing the analysis and mitigation of greenhouse gases for the implementation of CEQA by public agencies. The Amendments to the CEQA Guidelines were adopted by the California Natural Resources Agency (formerly Natural Resources Agency) March 18, 2010.

Local – The local air quality districts within the project boundaries oversee air quality standards in their respective areas, and also provide guidance for addressing GHG emissions and mitigation in CEQA documents. Folsom Lake Dam, Reservoir, and all appurtenant structures are located within portions of three separate counties: Eldorado, Placer, and Sacramento. Respectively, these counties also contain their own air quality districts. While Eldorado air district has not adopted thresholds of significance for GHGs, Sacramento Metropolitan Air Quality Management District (SMAQMD) and Placer County Air Pollution Control District (PCAPCD) have. On October 23, 2014, SMAQMD adopted Resolution 2014-028 that established recommended thresholds for GHGs. Following in November 2014, SMAQMD updated Chapter 6 of SMAQMD's CEQA Guide to Air Quality Assessment to provide guidance for agencies to specifically deal with GHG emissions, and included SMAQMD's recommended thresholds. More recently, on October 13, 2016, the PCAPD Board of Directors adopted the Review of Land Use Projects under CEQA Policy (Policy) and subsequently updated their CEQA thresholds of significance. Further descriptions of the laws and regulations can be found in Table 4-1 below.

Potential Environmental Effects

CEQA requires that lead agencies consider the reasonably foreseeable adverse environmental effects of projects they are considering for approval. CEQA requires that the cumulative impacts of GHG, even impacts that are relatively small on a global basis, need to be considered and if significant, consider feasible alternatives and mitigation measures that would substantially reduce significant adverse environmental effects.

Table 4-1. Summary of State Laws and Executive Orders that Address Climate Change.

Legislation Name	Signed/ Ordered	Description	CEQA Relevance
SB 1771	09/2000	Establishment of California Climate Registry to develop protocols for voluntary accounting and tracking of GHG emissions.	In 2007, DWR began tracking GHG emissions for all departmental operations.
AB 1473	07/2002	Directs CARB to establish fuel standards for noncommercial vehicles that would provide the maximum feasible reduction of GHGs.	Reduction of GHG emissions from noncommercial vehicle travel.
SB 1078, 107, EO S-14-08	09/2002, 09/2006, 11/2008	Establishment of renewable energy goals as a percentage of total energy supplied in the State.	Reduction of GHG emissions from purchased electrical power.
EO S-3-05, AB 32 [1]	06/2005, 09/2006	Establishment of statewide GHG reduction targets and biennial science assessment reporting on climate change impacts and adaptation and progress toward meeting GHG reduction goals.	Projects required to be consistent with statewide GHG reduction plan and reports will provide information for climate change adaptation analysis.
SB 1368	9/2006	Establishment of GHG emission performance standards for base load electrical power generation.	Reduction of GHG emissions from purchased electrical power.
EO S-1-07	01/2007	Establishment of Low Carbon Fuel Standard.	Reduction of GHG emissions from transportation activities.
SB 97[1]	08/2007	Directs OPR to develop guideline amendments for the analysis of climate change in CEQA documents.	Requires climate change analysis in all CEQA documents.
SB 375	09/2008	Requires metropolitan planning organizations to include sustainable communities' strategies in their regional transportation plans.	Reduction of GHG emissions associated with housing and transportation.
EO S-13-08 [1]	11/2008	Directs the Resource Agency to work with the National Academy of Sciences to produce a California Sea Level Rise Assessment Report, and directs the Climate Action Team to develop a California Climate Adaptation Strategy.	Information in the reports will provide information for climate change adaptation analysis.
EO B-30-15 [1]	04/2015	The order established a new interim greenhouse gas (GHG) reduction target to reduce GHGs to 40% below 1990 levels by 2030 in order to meet the target of reducing GHGs to 80% below 1990 levels by 2050.	State agencies with jurisdiction over sources of GHGs shall implement measures, pursuant to statutory authority, to achieve reductions of GHGs to meet the 2030 and 2050 GHG reduction targets.

[1]Significant laws and orders.

Thresholds of Significance

Guidance for determining significance of GHG emissions are evaluated against the following two criteria of CEQA Guidelines Appendix G:

- Will the project generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment
- Will the project conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases

More specifically, for stationary source facilities – an emissions unit consisting of a single emission source with an identified emission point – the annual direct operational GHG emissions should be compared to SMAQMD's and PCAPCD's 10,000 metric ton per year threshold of significance. If the annual direct GHG emissions exceed the threshold of significance, then the project may have a cumulatively considerable contribution to a significant cumulative environmental impact (SMAQMD CEQA Guidance 2016).

Methodology

This section provides the methods for calculating potential energy use and associated GHG emissions for operating the JFP. To calculate the amount of energy used, load calculations from the JFP design plans were reviewed and compared for opening all six-Tainter gates for 1-hour. This load calculation was then converted to CO2 equivalents in Metric Tons (CO2e MT) using the 2015 Sacramento Metropolitan Utility District's (SMUD) CO2 emission factor of pounds per Mega-watt-hour (lbs/MWh) provided from The Climate Registry's (TCR) Climate Registry Information System (CRIS).

According to the design plans, when all six-Tainter gates are opened for an hour, the load calculation would equal 277 kilo-Volt-amperes (kVA). kVAs are then converted to kilo-Watt hours (kWh) by multiplying by .9 kilo-Watts (kW)/kVA and multiplying by the hours in a year (365 days X 24-hours/day). Once kWh is determined, then CO2e in metric tons can be determined by using the conversion factor from TCR's CRIS emission factor of 590 lbs CO2/MWh. Kilo-Watt hours are converted first to Mega-Watt hour (MWh) by dividing kWh by 1,000. This answer is divided by 590, and then divided by 2,204.623 (1 metric ton = 2,204.623 lbs). The formula below shows the calculations for the conversion from kVA to MTCO2e per year for operating all six-Tainter gates 24-hours per day for an entire year:

$$\frac{277\ kVA}{project} \times \frac{.9kW}{kVA} \times \frac{8760\ hrs}{year} = 2{,}183{,}868\ kWh\ per\ year\ of\ the\ project$$

$$\frac{2{,}183{,}868\ kWh}{year} \times \frac{1\ MW}{1{,}000kW} = 2{,}183.868\ MWh\ per\ year\ of\ the\ project$$

$$\frac{2{,}183.868\ MWh}{year} \times \frac{590\ lbs\ CO2}{MWh} \times \frac{Metric\ Ton}{2{,}204.623\ lbs} = 584.445 \sim 584\ MTCO2e/year$$

Operational Assessment

Folsom Manual Update is an operational project evaluation assessing a change in operations for extremely low probability flood-rain-snowpack events with no additional physical construction. Implementation of the project does not generate GHG emissions from construction. Construction emissions for the JFP were covered in previous supplemental documents.

As noted in the climate change section, climate change is expected to cause the spring snowmelt to occur earlier in the spring. The result could increase spring flood risk. The proposed Manual Update operations are intended to reduce this risk through a change in the spring refill curve adjusted to allow for increased water supply storage in the spring.

Operating the JFP with all six-Tainter gates open 24-hours per day for an entire year would be equivalent to an estimated 584 metric tons of carbon dioxide (MTCO2) per year. The Folsom power plant, located at the foot of Folsom Dam on the north side of the American River and other CVP facilities primary function is to meet project pumping loads. Folsom itself produces enough hydropower per year to power all of the Folsom Facilities (e.g. pumping plant for water deliveries, main dam, and JFP), while the surplus power produced is marketed by Western Area Power Administration (WAPA) under long-term firm contracts to municipal and government entities. JFP uses 2,183,868 kWh when all six-Tainter gates are opened for an hour. Assuming that over the 82-year period, operating all six-Tainter gates rarely occurs, the energy use is a conservative estimate. JFP accounts for .003% of net total energy produced at Folsom Power plant. If the amount of energy used to power the JFP is converted from sending as surplus to the grid, then the inverse amount of CO2 emissions could be produced if that amount is replaced by burning fossil fuels.

The operation of Folsom dam will not directly produce GHG emissions due to the use of available hydropower, and the amount of energy to be used is far below the operation significance threshold for a stationary source of 10,000 MTCO2/year. By remaining within operational thresholds, the Manual Update will not directly or indirectly exceed GHG thresholds of significance, nor conflict with any applicable plan, policy, or guidelines.

In addition, the JFP will allow some operational flexibility to address foreseeable climate change impacts and have long-term benefits from the prevention of extra carbon production due to the demolition, repair, and reconstruction of flood induced infrastructure losses associated with catastrophic flooding events that could occur in the absence of the JFP.

Furthermore, by remaining within GHG thresholds of significance, and providing potential long-term benefits, the project would not conflict with SMAQMD's and PCAPCD's plans to reduce GHG emissions in the area nor CARB's scoping plan to reduce 2020 emissions to 1990 levels. Since the thresholds would not be exceeded, the Manual Update would not contribute to considerably cumulative impacts. Therefore, impacts due to a new Manual Update would be less than significant and there would be no cumulative impact.

4.1.2 Description of Resources

As discussed in Section 2, this SEA/EIR evaluates the effects of the alternatives on environmental resources both locally in the Sacramento area (Local Project Area), as well as regionally on the CVP/SWP system (regional effects assessment area). Thus, the affected environment/environmental setting are described separately for each project area under each resource in Sections 4.2-4.10.

Affected Environment and Environmental Setting under NEPA and CEQA

NEPA and CEQA differ in their approach to the existing conditions for environmental resources. Under NEPA, the existing conditions are referred to as the "affected environment," which is defined as the "environment of the area(s) to be affected … by the alternatives…" (42 U.S.C. 1502.15) at the point of initiation of construction. In comparison, CEQA refers to the existing conditions as the "environmental setting," which is defined as the "…environmental conditions in the vicinity of the project… at the time the notice of preparation is published" (14 CCR 15125).

Because the Manual Update does not involve any construction, the affected environment under NEPA is considered to be the environmental conditions at the time that the Manual Update is implemented in 2017. However, the environmental setting under CEQA is normally considered to be the environmental conditions at the time that the NOP was published, in October 2012 for this study. For this SEA/EIR, the 2012 and 2017 environmental conditions in the Local Project Area are assumed to be basically the same except for the status of the JFP.

Under construction in 2012, the JFP is assumed to be completed prior to implementation of the Manual Update in 2017. This includes construction of features, restoration of all disturbed areas, and implementation of all required mitigation measures. However, even though the JFP would be completed in 2017, it cannot be utilized without an approved water control plan (including WCD and ESRD) in place that provide the rules to operate the auxiliary spillway. As a result, operational constraints in 2017 would be assumed to be the same as those in 2012.

Level of Detail

The level of descriptive detail provided in Sections 4.2 to 4.10 differs for the Local Project Area and Regional Effects Assessment Area. All of the resources in the Local Project Area are described in more detail since changes in timing and flows from the Folsom Dam could have immediate and potentially significant effects in and around Folsom Reservoir, as well as in and along the lower American River and Sacramento River at the confluence.

Because of the nature of the improvements from the Manual Update, it is expected that operational changes that have little effect on the American River Basin would also have very little effects to resources in more distant parts of the system. For the regional effects assessment area, USACE, Reclamation, and CVFPB decided that this SEA/EIR would only include a "screening-level" evaluation for the effects of the Manual Update at the more distant parts of the CVP/SWP system. In addition, the screening would focus on those resources currently modeled by Reclamation and DWR as part of CVP/SWP's operations, primarily hydrology; water quality; fisheries (listed species); water supply and deliveries; and hydropower.

4.1.3 Environmental Baseline

The environmental baseline is considered to be the sum of the pre-project conditions in the project area. This baseline is used for comparison to determine the types, degree, and extent of any effects of the alternatives on the environmental resources. For this SEA/EIR, the baseline is considered to be the same as the NEPA affected environment and CEQA environmental setting discussed in Section 4.1. This assumes that the 2012 environmental setting per CEQA and 2017 affected environment per NEPA are basically the same except for the status of the JFP.

4.1.4 Future Without-Project Conditions

Future without-project conditions are the most likely conditions that would result if USACE, Reclamation, and local sponsors do not implement the Manual Update. These conditions would also include actions and projects that are currently authorized, funded, permitted, and/or highly likely to be implemented. For the Manual Update, the following assumptions are made for the future without-project conditions:

- The current 2004 Interim Agreement between Reclamation and SAFCA would be extended beyond 2018, and all JFP flood risk management and dam safety improvements would be completed at Folsom Dam and Reservoir. New rules and environmental considerations governing the operation of the JFP would not be in effect. Reclamation would continue to operate the dam using the WCD (400,000 af to 670,000 af) in the Interim Agreement without the use of the new spillway constructed as part of the JFP, as discussed in Section 3.1.2. However, in the extremely rare event where the structural integrity of the dam was at risk of failure, Reclamation would utilize the new spillway to maintain dam integrity.
- The WCD in the 2004 Interim Agreement would continue to credit storage conditions in Folsom Lake based on incidental storage space available at French Meadows, Hell Hole, and Union Valley Reservoirs calculated on a daily basis.
- Folsom and Nimbus Dams would continue to be operated by Reclamation to comply with the requirements and objectives in the Flow Management Standard (FMS) developed by the Water Forum for the lower American River. This includes minimum flow requirements and water temperature objectives. Minimum flow requirements vary based on hydrologic conditions in the American and Sacramento Rivers. Normally, these requirements range between 800 cfs and either 1,750 or 2,000 cfs, depending on the time of year and the water year type. Water temperature objectives of the FMS allow use of the Folsom Reservoir cold water pool for the protection of steelhead and fall-run Chinook salmon.
- Folsom and Nimbus Dams would continue to be operated by Reclamation as part of the CVP to comply with minimum flows dedicated and managed annually for fish, wildlife, and habitat restoration as defined by the Section 3406(b)(2) of the Central Valley Project Improvement Act (CVPIA).
- The CVP and SWP would be operated by Reclamation and DWR, respectively, to comply with the RPA actions presented in the 2008 U.S. Fish and Wildlife Service (USFWS) and 2009 National Marine Fisheries Service (NMFS) Biological Opinions issued for the coordinated long-term operations of the CVP/SWP. More details on how those RPA measures were represented in the CalSim II model can be found in Appendix A.

- Folsom and Nimbus Dams would continue to be operated by Reclamation to meet NMFS's current objectives, to the extent possible, for water temperatures in the lower American River. These objectives address the needs of Federally-listed salmonids in the river; i.e., steelhead incubation and rearing during the late spring and summer, and fall-run Chinook spawning and incubation starting in late October or early November.
- Folsom and Nimbus Dams would continue to be operated by Reclamation to meet the flow and timing needs, to the extent possible, of the Folsom and Nimbus Powerplants to generate electricity in accordance with the requirements of the CVP and preferred customers. Any remaining electricity from the plants would continue to be marketed by the Western Area Power Administration (WAPA) to various customers in northern California and Nevada.
- The level of demand for water supply in 2017 is assumed to be similar to that of the environmental baseline, the year 2012, with little change expected in the statutory, legislative, and regulatory constraints in operating the CVP/SWP within those years. In addition, the future without project condition assumes future level of water demand as described in the Long Term Operation CVP EIS.

4.1.5 Fixed-400,000 af flood storage operation

The environmental baseline and future without project condition account for the Reclamation-SAFCA Interim Agreement to operate Folsom with the variable space WCD from 400-670,000 af. USACE still prescribes operational decisions based on the 1986 WCD's flood storage space fixed at 400,000 af. Because these represent different conditions, an analysis was completed between a Fixed-400,000 operation and Alternative 2. Short or long term differences between these operational options result in no effects to negligible effects. This analysis is included in Appendix I.

4.1.6 Level of Demand

A comparison of environmental conditions under Alternative 2 to the No Action/No Project condition assuming a future level of water supply demand was evaluated and is included in Appendix H. Assumptions for the future level of water demand are reflected in the CalSim II modeling and are discussed further in Appendix A. These results were then compared to the modeling results assuming an existing level of demand, presented in the resource evaluations in the following sections. The modeling differences between existing and future demand are typically less than 5 percent (see Section 4.1.7 for a discussion on this threshold). Where applicable, existing versus future level of demand is discussed in each resource.

4.1.7 Basis of Significance

The basis of significance for each resource are based on CEQ's NEPA implementing regulations (40 CFR 1508.27) and CEQA Guidelines. Under NEPA, the significance of effects is a function of context and intensity. Context refers to the importance or regulatory status of the resource, while intensity refers to the magnitude – scale and duration – of the effect. Both beneficial and adverse effects are recognized, and either type can be significant. USACE has integrated NEPA into its planning regulations, policies, and guidance. USACE's Engineer Regulation 1105-2-100, "Planning Guidance Notebook," April 2000, establishes the following institutional, public, and technical significance criteria:

- Significance based on institutional recognition means that the importance of the effects is acknowledged in the laws, adopted plans, and other policy statements of public agencies and private groups. Institutional recognition is often in the form of specific criteria.
- Significance based on public recognition means that some segment of the general public recognized the importance of the effect. Public recognition may take the form of controversy, support, conflict, or opposition expressed formally or informally.
- Significance based on technical recognition means that the importance of an effect is based on the technical or scientific criteria related to critical resource characteristics.

For this SEA/EIR, these three NEPA criteria apply to all resources and are not repeated for each resource. The CEQA requirements are more specific to the resource and are listed in Appendix G of the CEQA Guidelines. The CEQA criteria relevant to the project area, as well as other agency criteria and thresholds of significance that apply to each resource, are identified under the appropriate resource in Sections 4.2-4.10.

The CalSim II model monthly simulation of an actual daily (or even hourly) operation of the CVP and SWP results in several limitations in use of the model results. The model results must be used in a comparative manner to reduce the effects of use of monthly assumptions and other assumptions that are indicative of real-time operations, but do not specifically match real-time observations. The CalSim II model output is based upon a monthly time step. The CalSim II model output includes minor fluctuations of up to 5 percent due to model assumptions and approaches. Therefore, if the quantitative changes between a specific alternative and the No Action Alternative are 5 percent or less, the conditions under the specific alternative would be considered to be "similar" to conditions under the No Action Alternative.

"Cumulative impacts" refers to two or more individual effects that, when combined, are considerable. Cumulative impacts can result from individually minor but collectively significant impacts taking place over time (CEQ NEPA regulations, Section 1508.7, CEQA regulations, Section 15355). The discussion of cumulative impacts provides an analysis of cumulative impacts of the project, taken together with other past, present, and reasonably foreseeable future projects, producing related impacts. The goal of this analysis is twofold: first, to determine whether the overall long-term impacts of all such projects would be cumulatively significant; and second, to determine whether the project itself would cause a "cumulatively considerable" incremental contribution to any such cumulatively significant impacts. In other words, the required analysis first creates a broad context in which to assess the project's incremental contribution to anticipated cumulative impacts, viewed on a geographic scale beyond the project site itself; and then determines whether the project's incremental contribution to any significant cumulative impacts from all projects is itself significant.

Table 4-2 identifies the other past, present, and reasonably foreseeable projects considered in the cumulative analysis. This list includes projects that are likely to result in impacts similar to those of the project alternatives. The list of projects generally includes those in the local project area.

Table 4-2. Cumulative Scenario – Present and Reasonably Foreseeable Projects.

Cumulative Scenario – Present and Reasonably Foreseeable Projects			
Project Name/ Location	**Status**	**Project Summary**	**Source**
Folsom Dam Raise	Ongoing	Raise existing height of Folsom Dam 3.5 feet to add surcharge space to maintain 115,000 cfs and 160,000 cfs releases from Folsom Dam for events beyond the 1 in 200 annual chance exceedance event	USACE & CVFPB (2017)
West Sacramento Flood Control Project General Reevaluations	Ongoing	Bring approximately 50+ miles of perimeter levees surrounding West Sacramento into compliance with applicable Federal and State standards for levees protecting urban areas. Proposed levee improvements would address: (1) seepage, (2) stability, (3) levee height, and (4) erosion concerns along the West Sacramento levee system. Measures to address these concerns would include seepage cutoff walls, seepage berms, stability berms, levee raises, flood walls, relief wells, sheet pile walls, jet grouting, and bank protection.	USACE & WEST SAFCA (2017)

4.1.8 Organization of Evaluation of Effects

The evaluation of the effects on the environmental resources includes a discussion of methodology, effects, significance, and mitigation for each resource.

Methodology to Determine Effects

Operations of both Folsom Reservoir and the CVP/SWP were simulated via computer modeling to either directly or indirectly help to determine the effects of the alternatives on the resources. Effects were based primarily on output from the HEC-ResSim and CalSim II models, but also supplemented by HEC-RAS models, water temperature models, fish mortality models, power generation models, and other models, as necessary. Previous operational studies, field surveys and reports, and best professional judgment were also considered in the effects determination. The discussion of methodology for each resource identifies the models used, as well as the application and the types of output applicable to each resource.

Determination and Significance of Effects

For the purposes of the NEPA/CEQA analyses in this document, the effect findings are defined more specifically below (in order of increasing severity to the environment).

- No Effect: An effect that would cause no discernible change in the environment as measured by the applicable significance criteria is a “no effect” determination; therefore, no mitigation would be required.
- Beneficial: A beneficial impact would generally be regarded as an improvement over current conditions.
- Negligible: A negligible impact would cause a slight, adverse change in the environment but one that generally would not be noticeable.
- Less than Significant: A less than significant effect would cause no substantial adverse change in the environment as measured by the applicable significance criteria; therefore, no mitigation would be required.
- Significant: A significant effect would cause a substantial adverse change in the physical conditions of the environment. Effects determined to be significant based on the significance criteria fall into two categories: those for which there is feasible mitigation available that would avoid or reduce the environmental effects to less-than-significant levels and those for which there is either no feasible mitigation available or for which, even with implementation of feasible mitigation measures, there would remain a significant adverse effect on the environment. Those effects that cannot be reduced to a less-than-significant level by mitigation are identified as significant and unavoidable, described below.
- Significant and Unavoidable: This effect would cause a substantial adverse change in the environment that cannot be avoided or mitigated to a less-than-significant level if the project is implemented. Even if the effect finding is still considered significant with the application of mitigation, the project proponent is obligated to incorporate all feasible measures to reduce the severity of the effect.
- Potentially Significant Impact: A potentially significant impact is one that if it were to occur, would be considered a significant impact as describe above. However, the occurrence of the impact cannot be immediately determined with certainty. For CEQA purposes, a potentially significant impact is treated as if it were a significant impact. Therefore, under CEQA, mitigation measures or alternatives to the Proposed Action must be provided, where necessary and applicable, to avoid or reduce the magnitude of significant impacts.
- Too Speculative for Meaningful Consideration: An impact may have a level of significance that is too uncertain to be reasonably determined, and would therefore be considered too speculative for meaningful consideration in accordance with State CEQA Guidelines CCR Section 15145. Where some degree of evidence points to the reasonable potential for a significant effect, the SEA/EIR may explain that a determination of significance is uncertain, but is still assumed to be “potentially significant,” as described above. In other circumstances, after thorough investigation, the determination of significance may still be considered too speculative to be meaningful. This is an effect for which the degree of significance cannot be determined for specific reasons, such as unpredictability of the occurrence or the severity of the impact, lack of methodology to evaluate the impact, or lack of an applicable significance threshold.

The organization of the effects discussion reflects the organization of the description in Sections 4.2-4.10. That is, the effects are evaluated separately for the two project areas under each resource. In addition, the effects of the alternatives are evaluated in detail for the Local Project Area, but only at a "screening level" for the regional effects assessment area. The rationale for this difference in the level of evaluation is discussed in Section 2.1.

Pursuant to NEPA and CEQA, both direct and indirect effects of the alternatives on each resource are to be evaluated in the SEA/EIR. However, implementation of the Manual Update would only involve modifying the operation of the Folsom Dam and Reservoir for flood risk management. There would be no construction or modification of any of the structural features of the dam or reservoir. This SEA/EIR considers the effects of implementing the Manual Update on environmental resources in Sections 4.2 to 4.10 to be mostly direct but with possible short term and long term consequences.

For the Local Project Area, the types, degree, and extent of both adverse and beneficial effects of the alternatives are determined based on a comparison of the environmental baseline condition with the detailed output of HEC-ResSim, CalSim II, other applicable models, previous operational studies, field surveys and reports, and best professional judgment. The effects on each resource are then compared with the significance criteria for that resource to determine whether the effects would be considered to be potentially significant based on context and intensity as defined by NEPA, as well as specific thresholds or standards defined by CEQA and other applicable Federal and State laws.

For the regional effects assessment area, the potential for long-term adverse effects of the alternatives is determined at selected locations (index points) using the various capabilities of the CalSim II model. The intent of this screening is to identify any potentially substantial adverse effects that seem to be attributable to the alternatives and evaluate the degree and extent of those effects in more detail in subsequent modeling studies, if necessary.

Avoidance, Minimization, and Mitigation

When possible, best management practices are identified and implemented to try and avoid, minimize, or reduce any potentially significant effects on the resources to less than significant. Mitigation measures are then developed to offset or reduce any remaining significant effects to less than significant, when possible.

Pursuant to CEQA, feasible mitigation measures that would reduce significant effects (determination of significance based on State significance criteria) must be implemented. While NEPA does not have this same implementation requirement for significant effects (significance based on Federal criteria), the Federal agency must justify its decision not to implement any feasible mitigation measures. Pursuant to both laws, a mitigation monitoring program would also be prepared and put in place to ensure that all mitigation measures are implemented.

4.2 Hydrology and Hydraulics

4.2.1 Environmental Setting/Affected Environment

Local Project Area

Section 2.1.1 fully describes the local project area. Local area resources specific to the Hydrology and Hydraulics analysis are described below.

<u>Floodplains</u>

The Sacramento River flood control system is made up of a series of reservoirs, bypasses, drainage canals, and levees stretching from Shasta Lake and Lake Oroville to the north and east, down to the mouth of the Yolo Bypass that empties into the Sacramento-San Joaquin Delta. The features of the flood control system around the Sacramento area are shown in Figure 4-6.

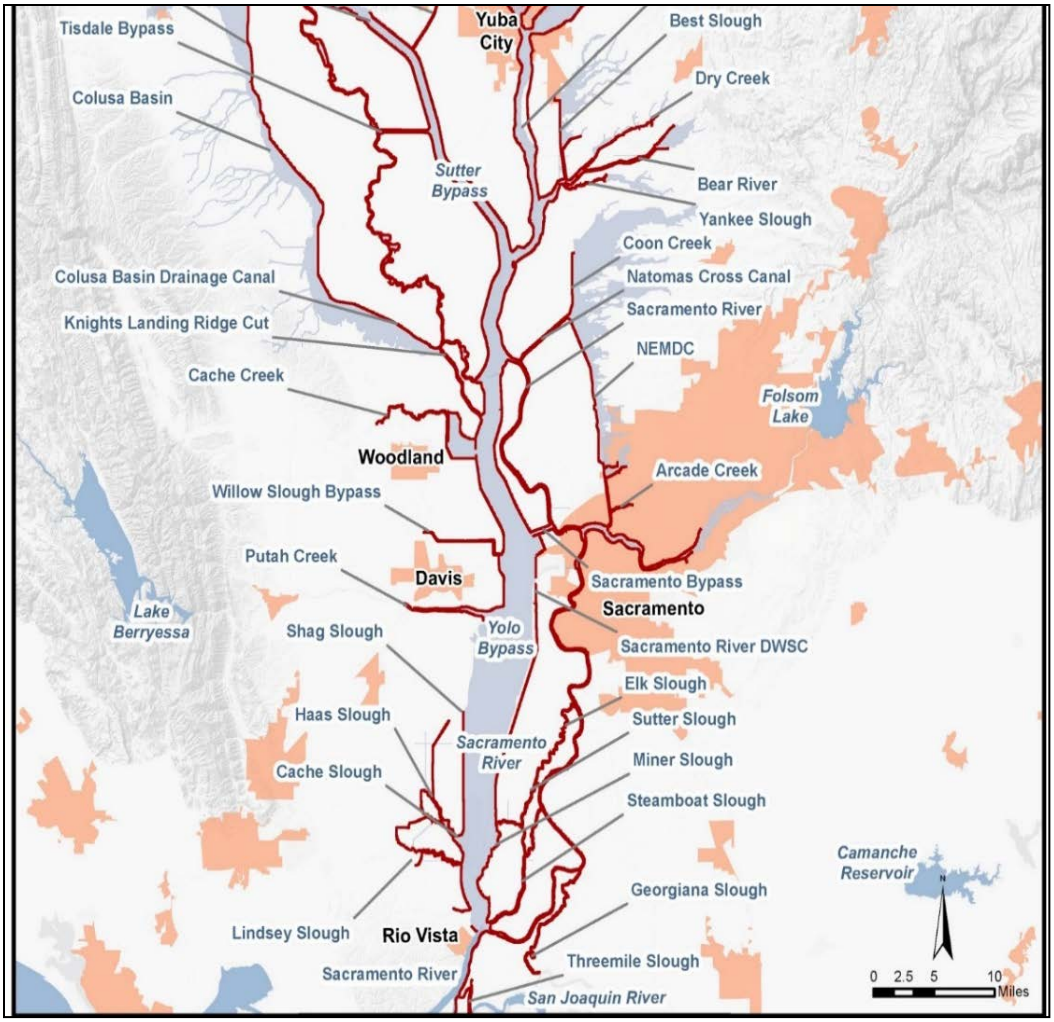


Figure 4-6. Sacramento River Flood Control System.

Under the future without project conditions, the American River levee system could accommodate Folsom Dam releases up to the 1/100 annual chance flow ("100-year") of 115,000 cfs. However, under current operations the 1/200 annual chance event ("200-year") would overtop the American River levees. A map of the inundated area of Sacramento and Arden-Arcade with the 1/200 annual chance event releases is shown in Figure 4-7. This figure represents a scenario of flooding based solely on floodwaters overtopping levees. It does not reflect flooding due to levee failure since levee fragility and potential for failure were the focus of the American River Common Features and West Sacramento Project GRRs, not the Manual Update.

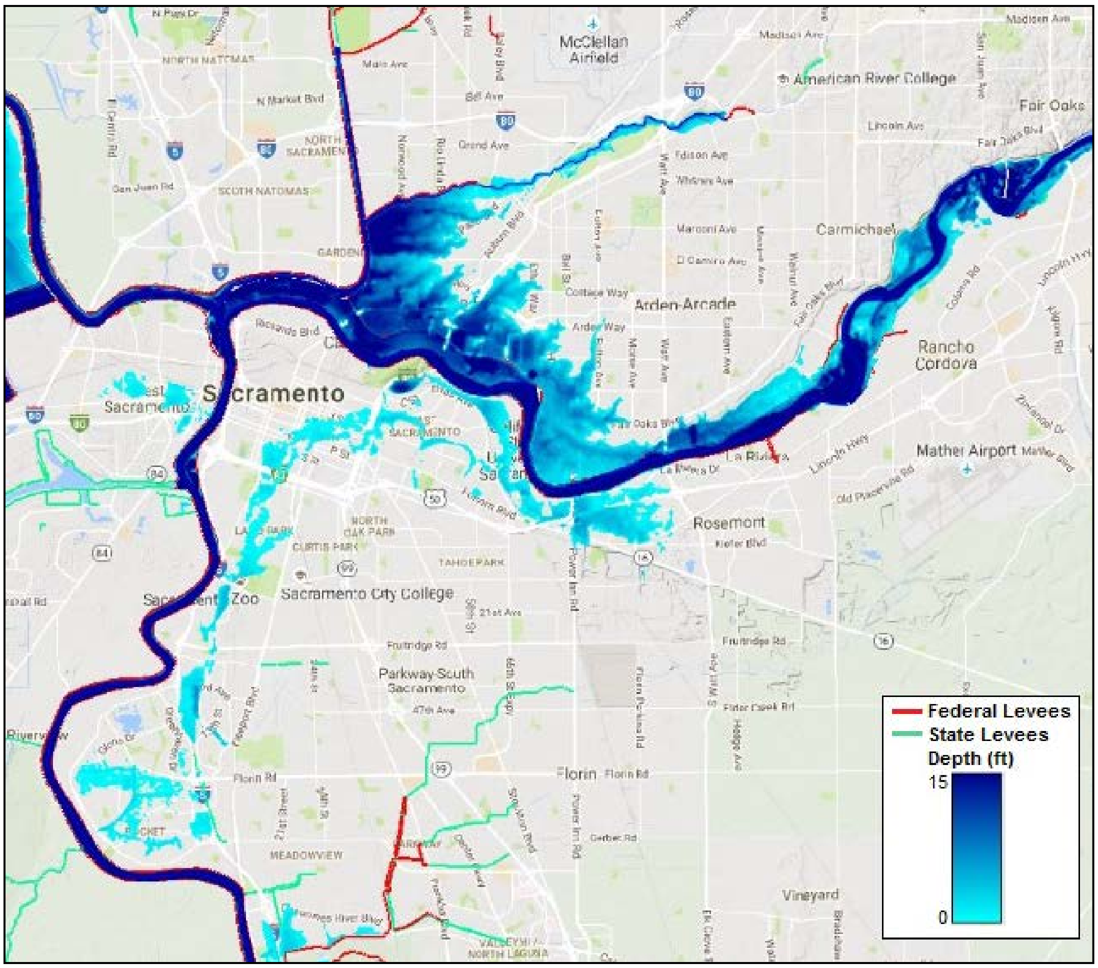


Figure 4-7. 200-Year Floodplain assuming no levee failure (No Action/No Project hydrology).

<u>Channel Stability and Sedimentation</u>

The Hydrology and Water Quality discussion in Section 3.4 of the 2015 American River Common Features GRR EIS/EIR generally characterizes the regional project area's existing condition for this resource. Numerous erosion assessments conducted over the years have indicated that there are existing levee erosion problems on the American River (USACE 2014b). Over a long time period (eg. the 82-year Period of Record), modeling simulations have indicated potential for catastrophic levee failure and loss of life during high flow, flood events. The recommended plan for the American River Common Features GRR would address those levee stability, seepage and erosion issues through erosion protection actions on the American River. .

Specific to the American River, multiple analyses have been completed and many are still underway to better understand the overall channel stability. General conclusions of the assessments to date were:

- The lower American River levees have experienced levee distress from erosion during most of the major flood events in the past.
- The lower American River has experienced near impending levee failure from erosion that was not visible until the water receded.
- Erosion on the lower American River has been observed for discharges as low as 7,000 cfs.
- While the channel bed may have stabilized vertically, the need for bed protection to prevent additional degradation that could threaten the integrity of the levees should be monitored.
- Failure to include the recommended erosion protection measures proposed by the American River Common Features Project GRR will likely lead to levee failure, catastrophic damages, and possibly lives lost.

The vertical degradation and lower American River bed gradation changes were estimated using the HEC-6T sediment transport model (NHC 2015). The results of the HEC-6T models indicate current areas of potential aggradation, degradation, and loss of spawning gravel. In general, under current operations at Folsom Dam, the HEC-6T modeling indicated the following results and trends for the lower American River based on an 82-year period of record simulation:

- The presence of an erosion resistant hard surface would likely prevent substantial degradation for portions of the channel, such as between River Miles 7 and 11.5.
- Upstream of RM 13 long-term degradation is expected.
- The furthest downstream reaches would experience a gradual aggradational trend.
- The middle reaches may experience very little vertical change.
- Loss of gravel size material is expected upstream of and in the vicinity of the Goethe Park Pedestrian Bridge around RM 13.
- The largest most infrequent discharges cause the most erosion for the upstream reaches (about RM 13 and higher).
- The long-term aggradational trend in the furthest downstream reaches is not substantially impacted by the largest most infrequent discharges.

The assessment of past levee performance and erosion assessments indicates a high risk of flooding from erosion-related failures for Existing Interim operation of Folsom Dam. Since the erosion assessment is comparing Existing Interim operation to alternative operation, the starting point for the comparison is high flood risk from erosion-related failures for Existing Interim operation. However, safety statements (eg. failure risk, loss of life, etc.) are not synonymous with NEPA-CEQA significance determinations.

Folsom Reservoir Bank Erosion

Reclamation reported the pool elevations in Folsom Lake that are the least susceptible to erosion as 395 feet to 466 feet NGVD (Reclamation 2004). In essence, Reclamation assumed that the banks within this elevation range have reached a limit of erosion and that no additional substantial erosion would be caused by wave action from the impounded water in Folsom Lake. Consequently, when water levels are either above or below this range, the earthen banks around the lake could be more susceptible to erosion. This tendency for erosion could affect resources surrounding the lake, such as habitat and cultural resources.

Regional Effects Assessment Area

The Hydrology and Water Quality discussion in Section 5 of the 2016 Coordinated Long Term Operation of the Central Valley Project and State Water Project EIS generally characterizes the regional project area's existing condition for this resource. For the regional effects assessment area, a screening-level analysis was carried out to evaluate changes in flow that could be seen on the Sacramento River and Feather River. Differences in monthly average in-stream flows, both long-term and by water-year type, were evaluated using CalSim II model period-of-record hydrology outputs on the Sacramento River and Feather River. The differences in flow on both rivers was equal to or less than 1% over the entire model period (Appendix A and Appendix E). As stated in Section 4.1, minor fluctuations of up to 5 percent are due to model assumptions and approaches. The CalSim II model run results produced similar conditions. Therefore, short and long-term effects are considered negligible to no effect and do not rise to a level of significance requiring additional analysis and discussion. See Appendix A for a discussion of CalSim II model results.

4.2.2 Environmental Consequences

A detailed discussion of the evaluation of hydrology and hydraulics changes as a result of the proposed Manual Update can be found in the Draft Folsom Dam Water Control Manual Update Engineering Report (USACE 2016). This report relied on modeling efforts from a Tetratech report on channel widening (2016) and NHC report on sediment mobilization (2015). All modeling scenarios (existing, Alternative 1 and Alternative 2) did not include USBR's existing CVPIA spawning gravel augmentation efforts, which were initiated in 2008 and will continue as long as CVPIA is in effect.

Methodology

The erosion assessment builds on past performance and previous erosion assessments. It compares predicted future erosion due to changes in Folsom Dam operations (Alternative 1 operation and Alternative 2 operation) to predicted future erosion from current Folsom Dam operations (Existing Interim operations). Given the existing channel stability and sedimentation trends identified for the lower American River in Section 4.2.1, NHC carried out an updated HEC-6T sediment transport analysis in 2015 that compared the vertical degradation potential of the No Action/No Project and with-project operations using earlier HEC-ResSim model iterations to simulate the 82-year period of record releases from Folsom Dam (NHC 2015). Alternative 1 results are presented as a quantitative measure against which Alternative 2 is qualitatively evaluated. The methods used for the analysis include:

1. Estimating the potential for channel widening
2. Modeling sediment transport using the HEC-6T software
3. Comparing existing and with-project Folsom Dam discharge distributions

Modeling, model output, and interpreting conclusions are based on post-flood event surveys and modeling efforts over an 82-year period of record. Model input is largely based on estimates and results in a large level of uncertainty. For example, the 2015 ARCF GRR modeling results for the existing condition produced a range of bed degradations for all subreaches downstream of Nimbus dam. Whereas, improved model data estimates and input parameters for the Manual Update indicate bed degradation in upstream reaches and bed aggradation in downstream reaches.

In addition, flood events comprise a small percentage of actual flow volumes over the entire period of record, and modeling scenarios are simple tools to evaluate existing condition(s) and effects of any range of project scenarios. The latter also results in a level of uncertainty both in model output and result interpretation. While a rare flood, high flow event that could result in erosion related safety issues is possible such as catastrophic levee failure or loss of life, the probability of these erosion issues occurring may not be NEPA-CEQA significant over the period of record modeled.

<u>Estimating the Potential for Channel Widening</u>

Estimating channel widening provides information on erosion risks to riparian habitat, levees, and other infrastructure that could be threatened by channel widening. Because the amount of channel widening varies spatially, the lower American River was sub-divided into ten geomorphic sub-reaches with similar geomorphic characteristics (see Figure 4-8). The channel widening analysis estimates the rate of channel widening using a sediment-accounting algorithm. The algorithm is dependent on the supply and size of sediment from upstream, the availability of sediment from bank erosion, the erodibility of bank material, and the sediment transport capacity of the channel. These are variable factors that change under different alternative conditions.

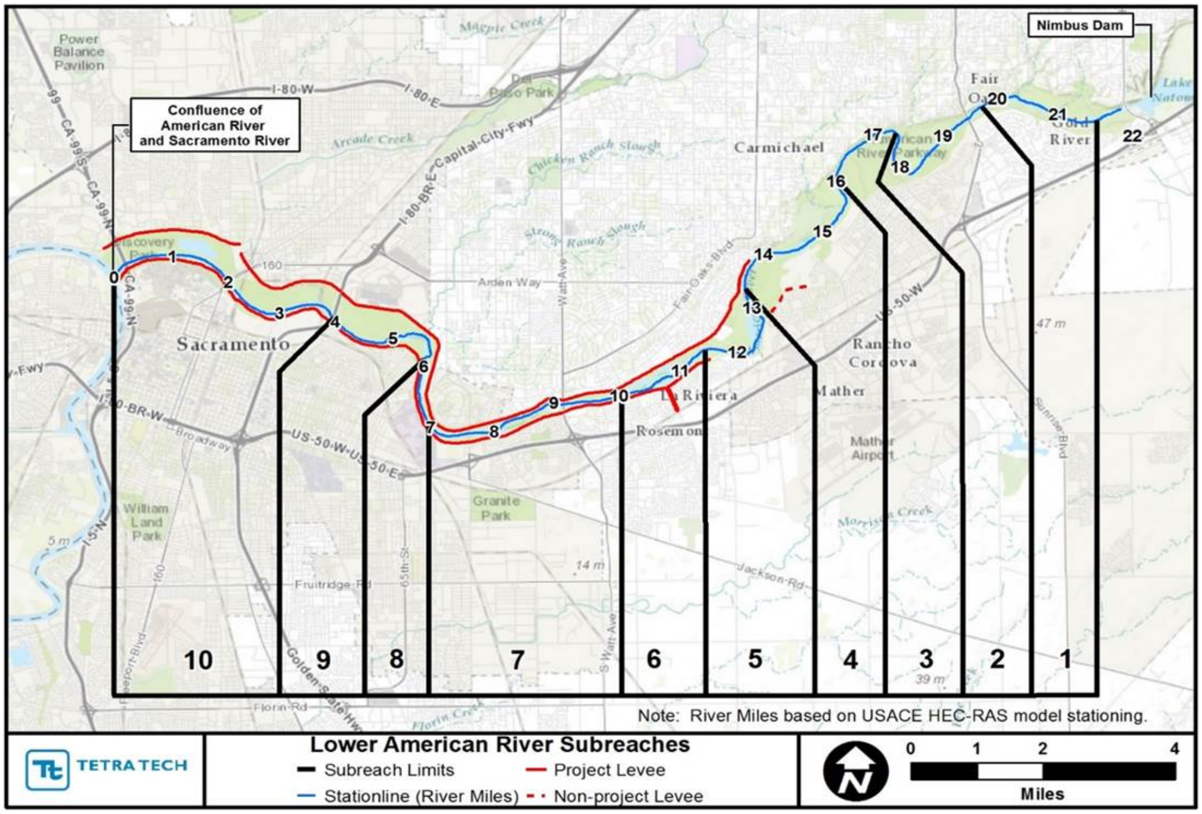


Figure 4-8. Lower American River Geomorphic Subreaches and River Miles Used in the Channel Widening Analysis.

Multiple estimates are developed to provide model input. Channel widening rate is estimated based on the potential magnitude of widening in each reach, which is based on an estimate of bank erosion rates over the period of record Existing Interim and Alternative 1 operations. A sensitivity analysis on the channel widening computations was conducted by varying the estimated vertical degradation of the channel (i.e., adjusting the longitudinal profile developed into Alternative Profile 1 and Alternative Profile 2 as shown on Figure 4-9), the threshold for incipient motion of the sediment (Shields Parameter), and the downstream stage.

Three scenarios were developed which represent the highest reasonable channel widening (scenario 1), the lowest reasonable channel widening (scenario 2), and an intermediate amount of channel widening (scenario 2) as shown in Table 4-3. The results of the channel widening analysis indicate which geomorphic sub-reaches may be at risk of increased channel widening for Alternative 1 operation relative to Existing Interim operation. The results inform the risk from lateral erosion to riparian habitat, levees, and other infrastructure from implementing Alternative 1 relative to Existing Interim operations. For additional details on the channel widening analysis, see Tetratech (2015).

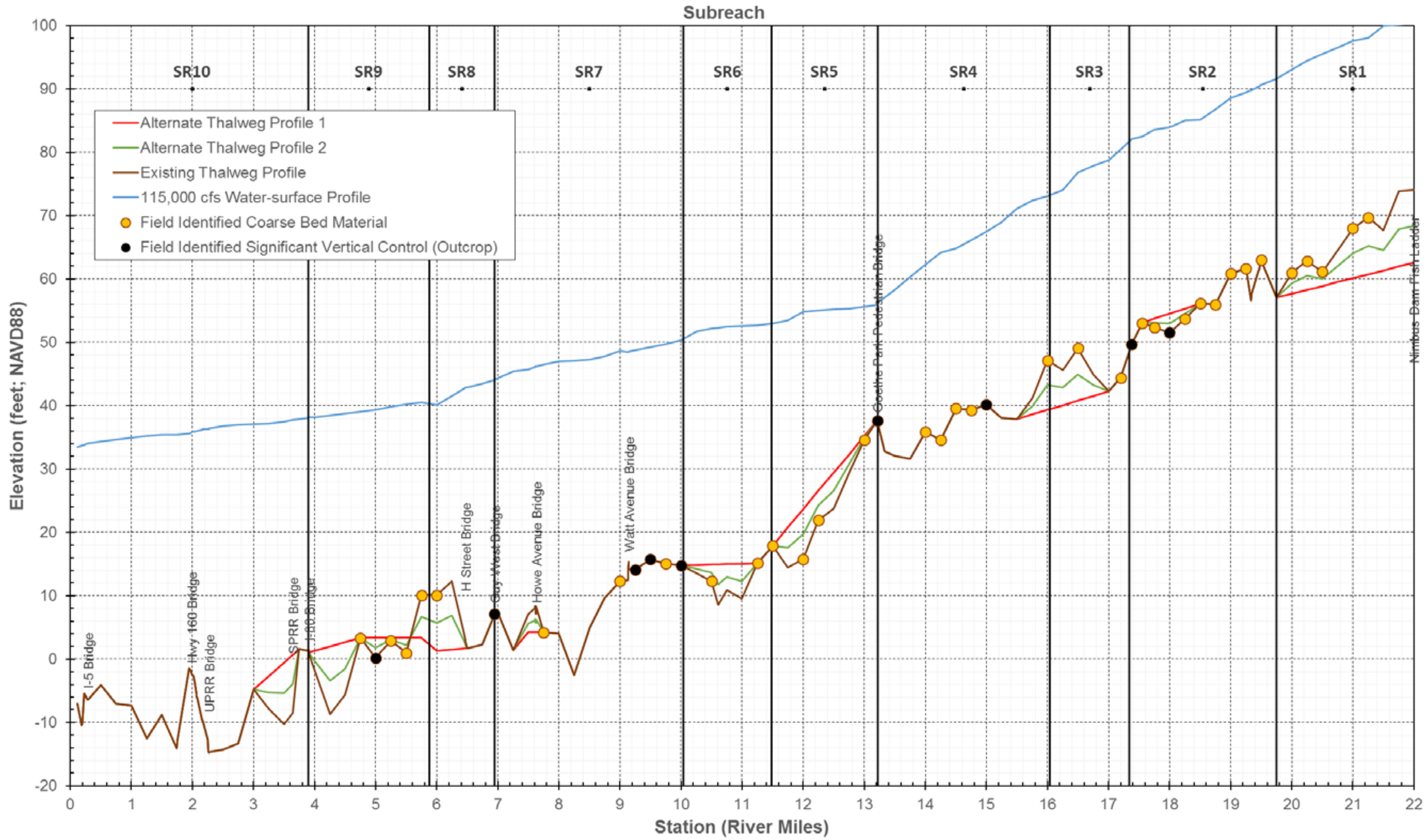


Figure 4-9. Existing Channel Bed Profile of the Lower American River Showing Alternate Channel Bed Profiles to Support the Sensitivity Analysis of Channel-Widening Potential.

Table 4-3. Summary and Definition of Variables used to Designate the Three Sensitivity Analysis Scenarios used for the Widening Analysis of the Lower American River.

Scenario	Channel Bed Profile	Downstream Rating Curve	Shields Parameter
Scenario 1	Existing Profile	Lower Curve	0.03
Scenario 2	Alternate Profile 2	Expected Curve	0.045
Scenario 3	Alternate Profile 1	Higher Curve	0.06

Over an 81-year period of record, average daily discharges were grouped by roughly 10 kcfs increments to create a discharge frequency distribution for Existing Interim, Alternative 1, and Alternative 2 operations. This was done for the Folsom Dam discharges used in the various analyses. These distributions were compared to show where changes to discharge magnitude, duration, and frequency may reduce or increase erosion for Alternative 2 operation compared to Existing Interim operation.

Erosion occurs when the erosive forces from flowing water are large enough for a long enough duration to overcome the resistive forces of the channel and/or banks. The discharge where erosion is estimated to begin is the critical discharge. Critical discharges for the channel and banks were developed for selected cross-sections based on the soil and bed material grain sizes, testing of the erosion resistance of the soil, and geologic mapping. The change in the total number of days (for the entire period of record) above the critical discharge is used to estimate if a cross-section is potentially impacted by additional erosion for Alternative 2 operation compared to Existing Interim operation. The percent of each geomorphic sub-reach potentially impacted by erosion was estimated. "Potentially impacted" is defined as increased erosion by implementing Alternative 2 operation compared to continuing Existing Interim operation. The percent of the sub-reach potentially impacted by additional erosion was estimated as the percent of the sub-reach with cross-sections that could reasonably be expected to experience increased erosion relative to Existing Interim operation.

Estimating the Potential for Folsom Lake Bank Erosion

In conjunction with the CalSim model outputs, HEC-ResSim model outputs were used to conduct a comparative analysis between the forecast-informed alternative and the No Action/No Project alternative to assess changes in the frequency of water surface elevation changes at Folsom Reservoir.

Basis of Significance

The thresholds of significance encompass the factors taken into account under NEPA to determine the significance of an impact in terms of its context and intensity. The thresholds for determining the significance of impacts for this analysis are based on the environmental checklist in Appendix G of the State CEQA Guidelines. Changes in flow conditions in the lower American River caused by changes in release patterns from Folsom Dam may affect erosion and scour potential along the river corridor. Changes in channel degradation and aggradation could in turn represent effects to other resources such as vegetation and wildlife, fisheries habitat, cultural resources, infrastructure, and recreational facilities.

Changes in flood risk reduction could also result in changes to the drawdown and refill frequency at Folsom Lake. These fluctuations in water surface elevation could represent a change in erosion activity along the lake's shoreline.

The alternatives would result in a significant impact if they would do any of the following:

- Substantially alter (defined as ≥5%) the existing drainage pattern of the area, including (1) substantial changes in erosion (eg. channel stability, sedimentation, bank erosion) or siltation throughout the region, and (2) substantial increase in the rate or amount of surface runoff in a manner that would result in flooding on- or off- site;
- Result in an increased exposure of people or structures to a significant risk of loss, injury or death involving flooding;
- Result in a significant (defined as ≥5%) increase in the number of occurrences that water surface elevations exceed 466 feet or go below 395 feet.

No Action/No Project

Under No Action/No Project, the operation of Folsom Dam would not be updated and the level of flood risk to the Sacramento Metropolitan area would remain the same. The completed auxiliary spillway would not be used except in extreme circumstances that threaten the structural integrity of the Folsom Dam. Folsom and Nimbus Dams would continue to be operated by Reclamation as part of the CVP to comply with existing flow requirements.

Without an updated WCM, the flood storage space in Folsom Reservoir would continue to be released to maintain the existing variable space 400,000 af to 670,000 af flood storage limit with a maximum release of 160,000 cfs, as prescribed in the 2004 SAFCA/Bureau Interim Agreement. During flood season, the existing release schedules limit any change in outflow from Folsom Dam to 15,000 cfs per 2-hour period when inflows are increasing and 10,000 cfs per 2-hour period when inflows are decreasing.

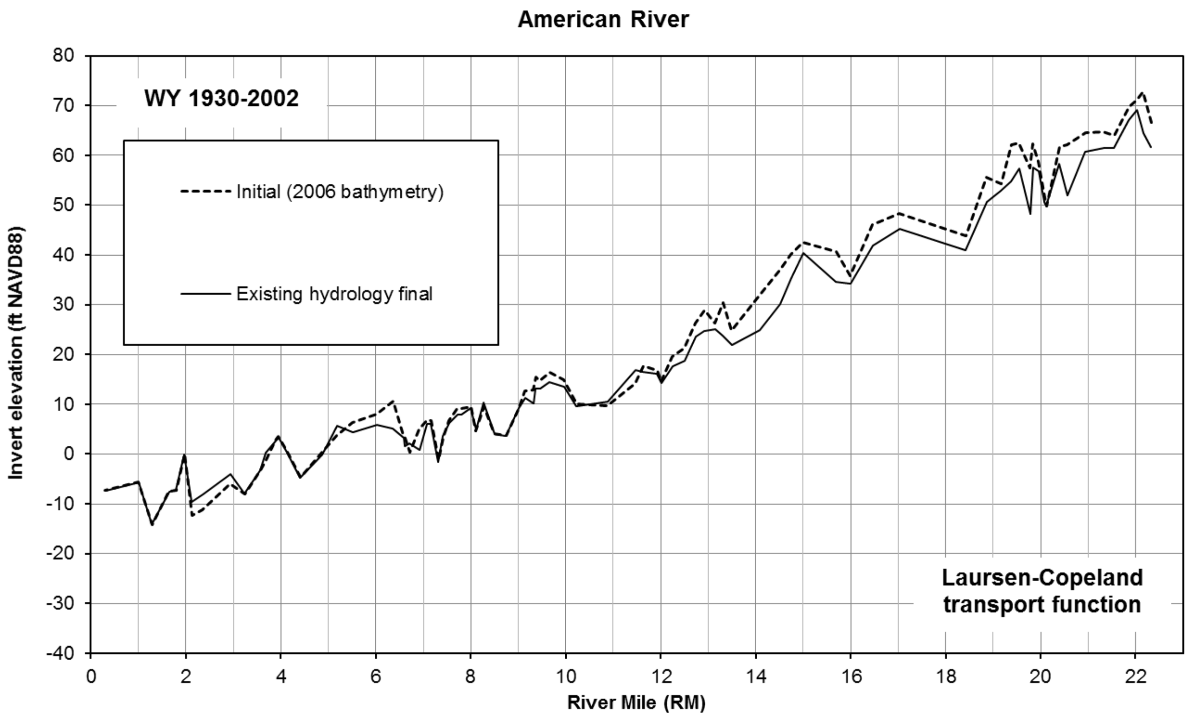
Under No Action/No Project operations, floodwaters would expect to overtop levees in the lower American River at the 1 in 150 annual exceedance probability (AEP) event. Therefore, there is no change in existing exposure to loss, injury, or death due to flooding.

Channel Stability and Sedimentation

With no Federal or State action taken to update the Folsom Dam and Lake Water Control Manual, channel stability and sedimentation rates would continue as described in Section 4.2.1. Therefore, water stored in the Folsom Reservoir would continue to be released as rapidly as possible to maintain the existing variable space 400,000 acre-feet to 670,000 acre-feet flood storage limit with a maximum release of 160,000 cfs, as prescribed in the 2004 SAFCA/Bureau Interim Agreement.

The computed change of channel invert elevations in the lower American River from the 2015 HEC-6T sedimentation analysis are summarized in Figure 4-10. Average changes in the channel invert for the No Action/No Project alternative was -1.84 feet of vertical degradation. The maximum vertical degradation was -10.02 feet at RM 20.5 and the maximum vertical aggradation was 2.91 feet at RM 2.3.

Since no action is being taken to change the existing rates of aggradation and degradation the No Action/No Project alternative would have no change to erosion rates.



Source: Sacramento River Sediment Study Phase II Lower American River HEC-6T Model Update (NHC 2015)

Figure 4-10. Computed change from the initial channel invert (2006 bathymetry) to the No Action/No Project channel invert over an 82-year period of record (WY 1921-2002).

For the Sacramento River, the 2012 NHC sediment budget study evaluated existing trends in channel planform evolutions in overbank berms (floodplain terraces). A series of historical bankline shift maps were produced for the 2012 study of the Sacramento River for the 1949 and 1952 to 2005 period using historical aerial photographs and maps. For most of the study reach, the river channel is closely bordered by extensively revetted levees and lateral channel evolution is limited.

The results of the long-term HEC-6T simulations showed that the longitudinal bed profile in the study reach of the Sacramento River is generally stable, as has been observed by small changes in stage discharge rating curves over the previous few decades. Future trends in the river planform evolution are not expected to change from those identified in the 2012 study, measured over the same multi decadal time period. Assuming persistence of present day climatic conditions and the generally stable to slightly degradational longitudinal profile determined in this modeling study, the potential future loss in overbank berm area in the study reach of the Sacramento River is estimated to be similar to the historic loss, i.e. on the order of 84 acres (or 4.0% of the total overbank berms area) over the next 50 years.

Therefore, under the No Action/No Project, the effect to the existing drainage pattern and run-off does not exceed the thresholds and is considered negligible to less than significant.

Alternative 2 – Forecast Informed Operations with Variable Folsom Flood Control Space (400,000 af to 600,000 af)

Local Project Area

Differences in monthly average in-stream flows, both long-term and by water-year type, were evaluated using HEC-ResSim and HEC-RAS model period-of-record hydrology outputs for the lower American River. In addition, differences in floodplains along the lower American River Basin were also evaluated.

Lower American River Flows

The synthetic period of record under Alternative 2 and No Action/No Project was evaluated to determine the probability that a particular flow was exceeded during the complete period of record. This is a probability of occurrences based on the period of record itself, similar to a count of occurrences a particular flow was exceeded.

As shown in Figure 4-11 and Figure 4-12, Alternative 2 – Forecast-informed Operations (J602F3) is capable of passing more rare events at the normal and emergency objective releases of 115,000 cfs and 160,000 cfs than No Action/No Project (E504). In particular, the 1 in 200 annual chance of exceedance (ACE) event would be contained within the existing channel of the lower American River, whereas the No Action/No Project operation would experience floodwaters overtopping the levees at the 1 in 150 AEP event.

As shown in Table 4-4, when comparing the Alternative 2 modeled daily discharge frequencies to No Action/No Project operation, evaluating the change in days within each discharge range would result in a significant change for multiple ranges. However, the value in this interpretation is limited by the small frequency and rarity with which these discharges rates occur. The percent change in days for each discharge range interval is <1 percent (+/-) for every range. While there are increases and decreases over every range, overall the high flow events >30,000 cfs decline from 158 days to 115 days, a 37 percent decrease. High flow events are indicative of increased potential for bed mobilization, erosion, and safety issues.

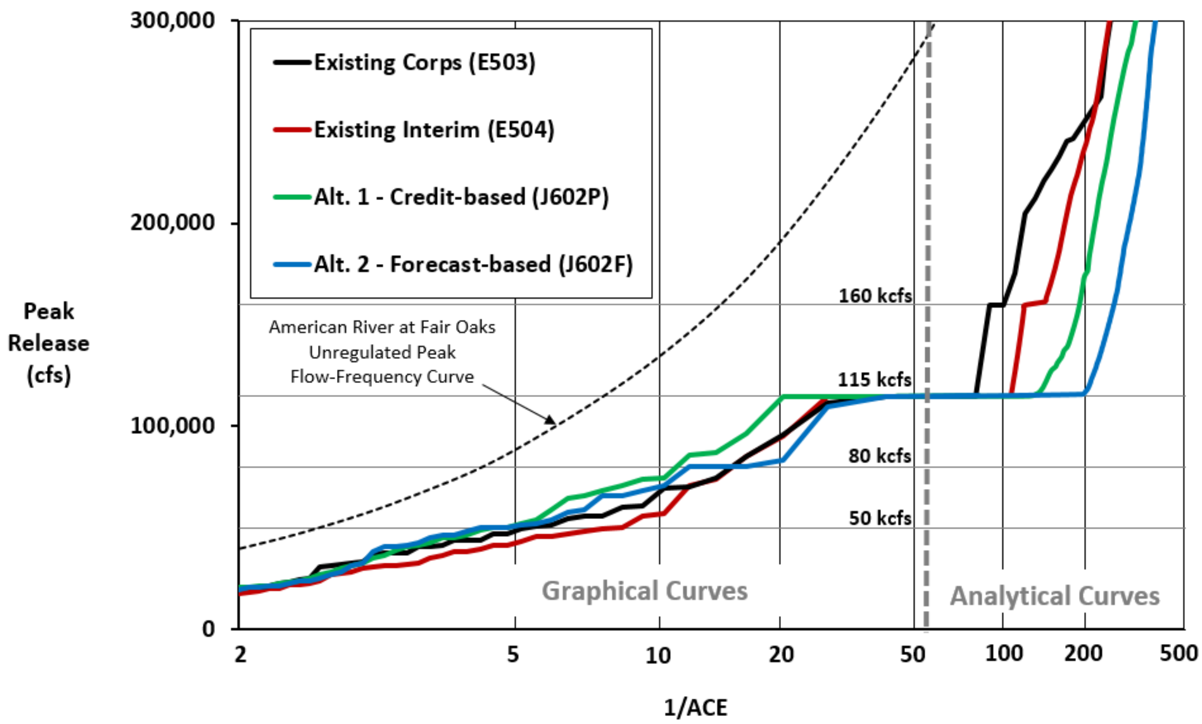


Figure 4-11. Lower American River Flow Frequency Curves of the Operation Scenarios Modeled for the Manual Update.

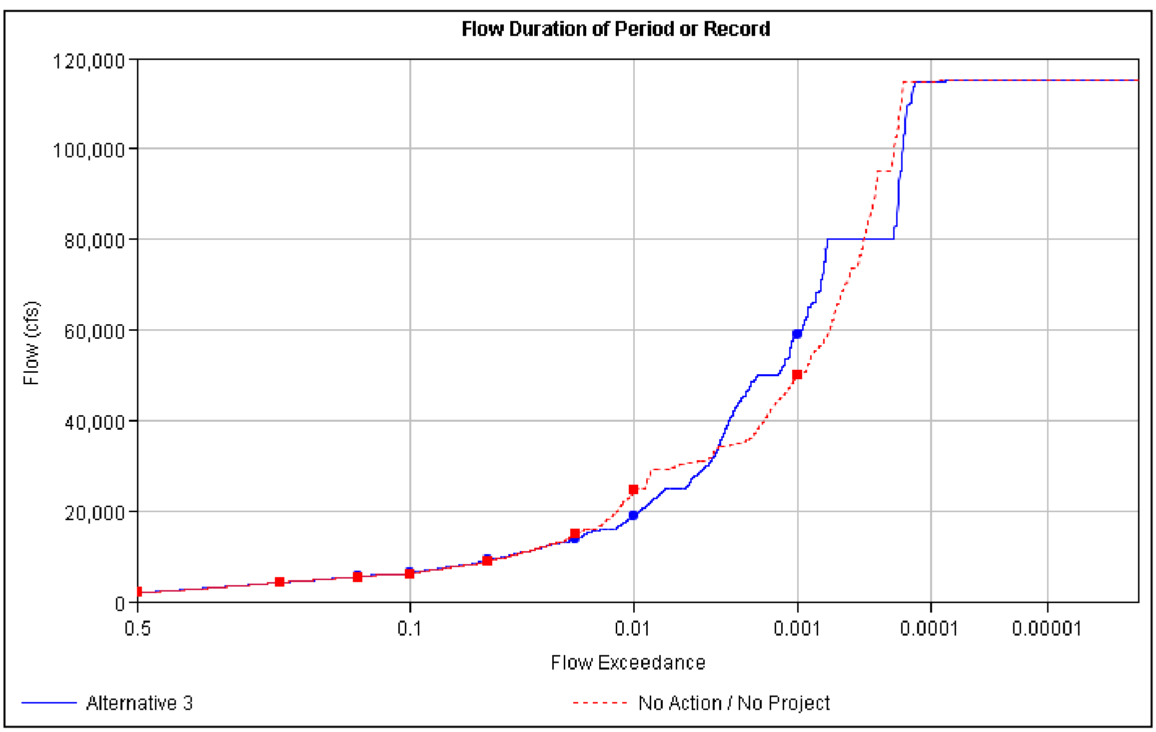


Figure 4-12. Probability of Flow Exceedance for Alternative 2 and No Action/No Project for the 82-year period of record flows in the Lower American River.

Table 4-4. Modeled Average Daily Discharge Frequencies for No Action/No Project and Alternative 2 – Forecast-informed Operations.

Discharge Range (cfs)	No Action/No Project Discharge Frequencies (# of days)	% of Overall Days	Alternative 2 – Forecast-informed Operations Discharge Frequencies (# of days)	% of Overall Days	% Overall Change	% Change in # of Days
< 10,000	28,388	95.98	28,348	95.84	-0.14	-0.14
10,000 to < 20,000	830	2.8	967	3.3	0.5	16.5
20,000 to < 30,000	202	0.68	147	0.49	-0.19	-37.4
30,000 to < 40,000	109	0.37	40	0.13	-0.24	-63.3
40,000 to < 50,000	22	0.074	39	0.13	0.056	77.3
50,000 to < 60,000	8	0.027	15	0.05	0.023	87.5
60,000 to < 70,000	6	0.02	3	0.01	-0.01	-100
70,000 to < 80,000	4	0.013	11	0.037	0.024	175
80,000 to < 90,000	1	0.0033	3	0.01	0.0067	300
90,000 to < 100,000	2	0.0067	1	0.0033	-0.0034	-50
100,000 to 115,000	6	0.02	4	0.013	-0.007	-66.7

Overall, Alternative 2 deviates less than 0.6 percent of the time from No Action/No Project operations. Flood risk management benefits of Alternative 2 are not realized until flows exceed 80,000 cfs when the new auxiliary spillway allows Folsom Dam to hold sustained flows for a longer duration. Therefore, there is the potential for a beneficial change (or reduction) in existing exposure to loss, injury, or death due to flooding.

Channel Stability and Sedimentation

Alternative 2 erosion comparisons to the No Action and Alternative 1 model results vary and contain a high level of uncertainty as noted in the 4.2.2 Methodology. A detailed discussion of the hydrology-hydraulics modeling results are presented in the Engineering Report of the Manual Update (USACE 2017) and summarized herein. Proposed changes to Folsom Dam operations in the Manual Update could result in slight increases, decreases, or no change in erosion aggradation and degradation to the channel bed or channel widening dependent on subreach evaluated and critical discharge rates at each subreach. Critical discharge is identified as the rate at which erosion begins. The critical discharge for each geomorphic sub-reach was estimated and results are summarized in Table 4-5. Existing channel widening trends in the lower American River are anticipated to continue at a similar rate under both No Action/No Project and Alternative 2 operations. With the current risk of erosion to the channel and particularly the levee system, the channel widening analysis results have confirmed the need for increasing the level of erosion protection along the lower American River to sustain flood risk reduction benefits provided by the levee system to the Sacramento area. As indicated in Table 4-6 and Table 4-7, implementation of the erosion protection recommended by the American River Common Features GRR would reduce the risk of potential bank and channel impacts to less than significant.

Table 4-5. Critical Discharge Summary by Subreach with Project Conditions (Alternative 2).

	Location		Left Bank			Channel Bed			Right Bank		
Sub-Reach	**Upstream River Station**	**Downstream River Station**	**Q Critical Average (cfs)**	**Q Critical Max (cfs)**	**Q Critical Min (cfs)**	**Q Critical Average (cfs)**	**Q Critical Max (cfs)**	**Q Critical Min (cfs)**	**Q Critical Average (cfs)**	**Q Critical Max (cfs)**	**Q Critical Min (cfs)**
SR1	22	19.753	91,101	>160,000	31,806	45,892	>160,000	9,200	91,101	>160,000	31,806
SR2	19.75	17.38	85,913	>160,000	54,444	29,895	118,000	3,686	85,913	>160,000	54,444
SR3	17.29	16.0833	78,671	158,333	33,056	31,255	43,500	14,400	78,671	158,333	33,056
SR4	16	13.22	105,205	>160,000	44,583	28,426	47,000	16,500	116,079	>160,000	44,583
SR5	13.216	11.5	29,429	>160,000	1,000	60,745	>160,000	2,300	29,429	>160,000	1,000
SR6	11.416	10.0833	77,833	>160,000	13,500	141,667	>160,000	73,000	77,833	>160,000	13,500
SR7	10	6.951	60,600	>160,000	500	76,791	>160,000	500	56,050	>160,000	500
SR8	6.948	5.91666	>160,000	>160,000	>160,000	33,490	51,000	1,625	54,563	>160,000	1,000
SR9	5.833	3.913	118,525	>160,000	13,200	108,563	>160,000	85,000	84,625	>160,000	1,778
SR10	3.894	0.115	94,957	>160,000	21,667	3,294	5,300	500	64,765	>160,000	21,667

Table 4-6. Summary of the percent the total sub-reach length potentially impacted by changing operation from Folsom Dam existing operations (existing conditions) to proposed Manual Update operations (with-project conditions).

	Location				
Sub-Reach	**Upstream River Station**	**Downstream River Station**	**Estimated percent of Left Bank Potentially Impacted**	**Estimated percent of Channel Potentially Impacted**	**Estimated percent of Right Bank Potentially Impacted**
SR1	22	19.753	28 percent	28 percent	28 percent
SR2	19.75	17.38	45 percent	21 percent	45 percent
SR3	17.29	16.0833	38 percent	62 percent	38 percent
SR4	16	13.22	49 percent	32 percent	41 percent
SR5	13.216	11.5	28 percent	14 percent	28 percent
SR6	11.416	10.0833	60 percent	20 percent	60 percent
SR7	10	6.951	31 percent	62 percent	38 percent
SR8	6.948	5.91666	0 percent	50 percent	0 percent
SR9	5.833	3.913	39 percent	0 percent	61 percent
SR10	3.894	0.115	0 percent	0 percent	0 percent

Table 4-7. Summary of the percent the total sub-reach length potentially affected with American River Common Features Project bank protection in place.

	Model Location		Additional Erosive Days		
Sub-Reach	**Upstream River Station**	**Downstream River Station**	**Estimated percent of Left Bank Potentially Impacted**	**Estimated percent of Channel Potentially Impacted**	**Estimated percent of Right Bank Potentially Impacted**
SR1	22	19.753	28 percent	28 percent	28 percent
SR2	19.75	17.38	45 percent	21 percent	45 percent
SR3	17.29	16.0833	38 percent	62 percent	38 percent
SR4	16	13.22	49 percent	32 percent	41 percent
SR5	13.216	11.5	28 percent	14 percent	28 percent
SR6	11.416	10.0833	0 percent	20 percent	60 percent
SR7	10	6.951	0 percent	62 percent	8 percent
SR8	6.948	5.91666	0 percent	50 percent	0 percent
SR9	5.833	3.913	0 percent	0 percent	61 percent
SR10	3.894	0.115	0 percent	0 percent	0 percent

The results of the Folsom Dam Discharge Distribution comparison reveals that there is a wide range of critical discharges along the entire lower American River, which is likely reflective of natural variability along the river. In addition, some areas of the lower American River will likely not be affected by the proposed changes to Folsom Dam operations in the Manual Update, whereas other areas will likely be affected.

In general, existing channel widening rates are not expected to change significantly under Alternative 2 operations. The period of record modeling flow variation between the No Project and Alternative 2 is 0.6 percent, which is well below the 5 percent modeling significance threshold. Based on Tetratech's 2015 channel widening analysis and the Engineering Report for the Manual Update (USACE 2017), expected trends over the 82-year period of record under both the No Action/No Project and Alternative 2 operations improved upon the model efforts from the ARCF GRR.

Several sedimentation analyses have also been completed by USACE (2017), Tetratech (2016), and NHC (2015). As part of NHC's 2015 sediment transport analysis, the difference between the 2006 channel invert, the No Action/No Project channel invert, and the with-project channel invert were computed, as shown in Figure 4-13. Relative to the overall change in channel invert from the 2006 bathymetry to the No Action/No Project condition, changes to the channel invert resulting from with-project operations modeled at that time appear very consistent with the No Action/No Project condition.

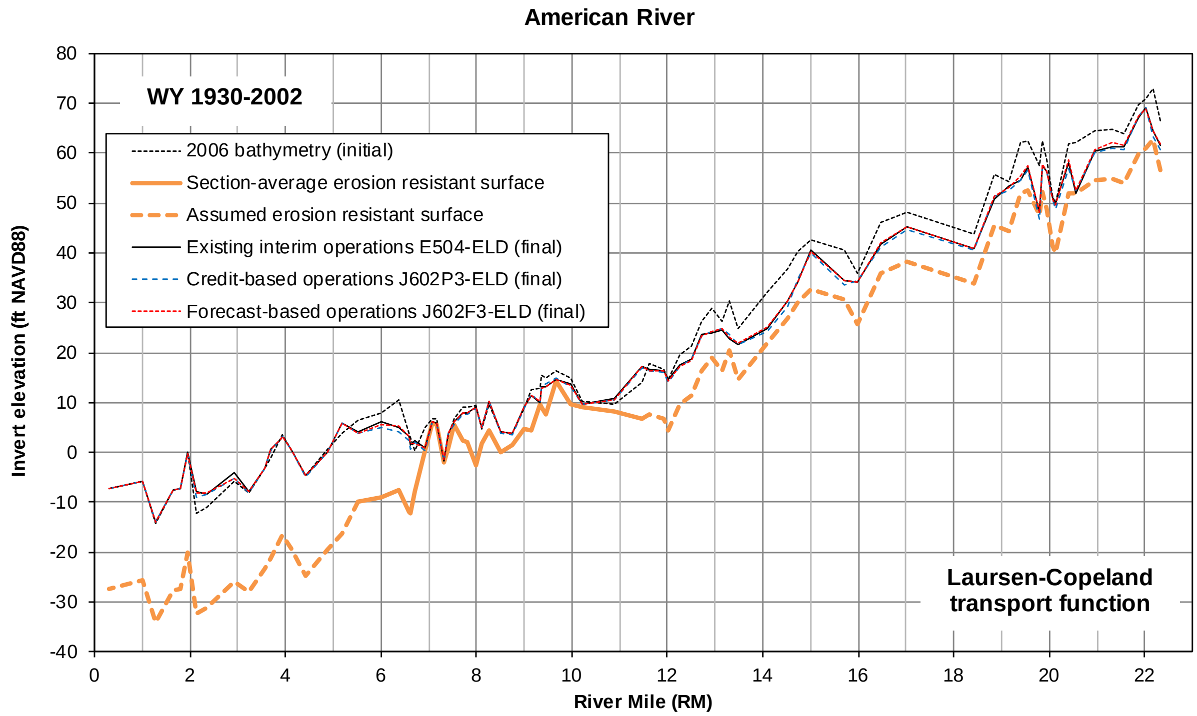


Figure 4-13. Computed change: initial channel invert (2006 bathymetry) to No Action/No Project channel invert and with-project channel invert (modified from NHC, 2017).

While the HEC-ResSim models used to simulate the period of record hydrology for operation of the No Action/No Project and Alternative 2 have been revised to capture subsequent iterations of operation rules and model refinements, an analysis of the distribution of the average daily discharges for the entire period of record for approximately 10,000 cfs increments indicates very minor differences between the with-project hydrology used in the 2015 analysis and the period of record hydrology for Alternative 2, as shown in Table 4-8 (see 4.2.2 Methodology section for description of qualitative analysis between Alternative 1 modeling and Alternative 2).

The three main differences noted between the Alternative 2 discharge frequencies and the NHC 2015 with-project discharge frequencies are that Alternative 2 has a slight increase in occurrences of the 10,000 cfs to 30,000 cfs range, an increase in the 50,000 cfs to 80,000 cfs range, and a large reduction in the 80,000 cfs to 115,000 cfs range. Typically, the large magnitude discharges would create the greatest occurrences of episodic channel erosion, so a significant reduction in the largest of these events (80,000 cfs to 115,000 cfs) observed in Alternative 2 model outputs would indicate better channel stability. In addition, overall the high flow events >30,000 cfs decline from 158 days to 115 days. A 37 percent decrease. Relatively speaking, some of this benefit would appear to be lost due to the increase in flows of the 50,000 cfs to 80,000 cfs range. Except as discussed in the Fisheries Section 4.5.2 Alternative 2, beneficial spawning gravel mobilization occurs most frequently in the 50,000 cfs to 80,000 cfs range. Given that this system realizes the greatest amount of channel degradation and aggradation with flows above 100,000 cfs, the reduction in these flows under Alternative 2 would indicate that there should be a slight reduction overall in channel aggradation and degradation based on these differences. However, for purposes of the NHC evaluation, flow discharge frequencies for Alternative 2 are assumed to be similar to the with-project discharge frequencies used in the 2015 HEC-6T analysis.

Table 4-8. Modeled Average Daily Flows for With-project Period of Record Hydrology used in the 2015 HEC-6T Lower American River Sediment Transport Evaluation and Alternative 2 – Forecast-informed Operations

Discharge Range (cfs)	No Action/No Project Discharge Frequency (# of days)	Alt 1 – Discharge Frequency (# of days)	Alt 2 – Discharge Frequency (# of days)	% Change No Action to Alt 1	% Change No Action to Alt 2	% Change Alt 1 to Alt 2
< 10,000	28,388	28,475	28,348	0.003	-0.14	-0.0045
10,000 to < 20,000	830	849	967	0.023	16.5	13.9
20,000 to < 30,000	202	134	147	-50.75	-37.4	9.7
30,000 to < 40,000	109	40	40	-63.3	-63.3	0
40,000 to < 50,000	22	42	39	90.9	77.3	8.4
50,000 to < 60,000	8	10	15	25	87.5	50
60,000 to < 70,000	6	6	3	0	-100	-100
70,000 to < 80,000	4	2	11	-50	175	550
80,000 to < 90,000	1	7	3	700	300	-57.1
90,000 to < 100,000	2	1	1	-50	-50	0
100,000 to 115,000	6	12	4	200	-66.7	-66.7

Figure 4-14 presents a closer assessment of the net invert elevation change predicted in the 2015 HEC-6T analysis between No Action/No Project and with-project operations. Increased degradational potential as a result of with-project operations was identified at six segments from RM 22 to RM 21; RM 18 to RM 16.5; RM 15.5; RM 12.5; RM 6.5 to RM 5.5; and RM 3 to RM 2.5 (see Figure 4-8 for an approximate comparison of river mile to subreach). These increases in degradation were all less than 1 foot except for around RM 16.5, RM 6.5, and RM 6.0. Overall, degradational trends indicates those RM's or subreaches just below Nimbus dam may experience an approximate total bed volume change of -550,000CY (RM 20-22, subreach 1) and -750,000CY (RM 15-20, subreaches 2-4), and aggradational trends ranging from 300,000CY, 150,000CY and 500,000CY between subreaches 5 to 10 (or RM 10-15, 5-10 and 0-5 respectively). These are aggradational and degradational estimates over the entire POR modeled. This evaluation improved upon the ARCF GRR modeling efforts, which indicated degradational trends for all RM and subreaches below Nimbus. On average, the degradational trends are 6,700CY and 9,100CY annually for RM 20-22 and RM 15-20. Degradation of spawning gravel substrate is a potential impact. However, USBR has implemented a CVPIA requirement for spawning gravel augmentation in the lower American River below Nimbus Dam. USBR has averaged 10,000CY of augmentation per year with ranges between 5,000 CY to 35,000 CY. See Fisheries section 4.5.2 Alternative 2 Lower American River Spawning Gravel Mobilization for detailed discussion on this ongoing project.

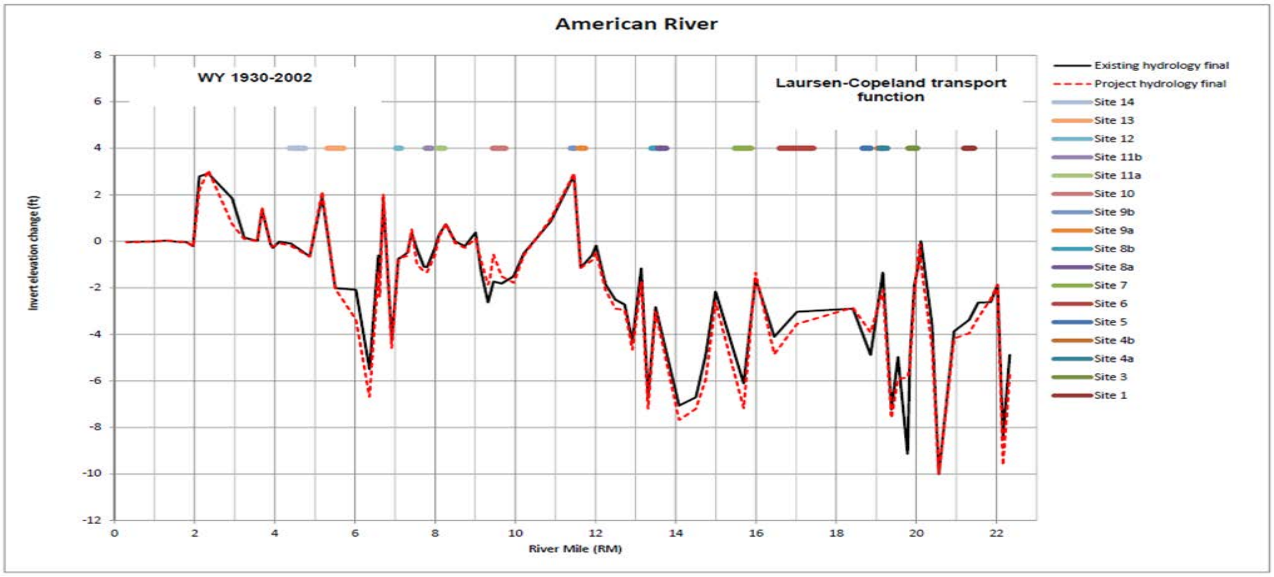


Figure 4-14. HEC-6T Sediment Transport Analysis Computed Net Changes in Invert Elevations in American River (Long-term Simulations, Existing and Project Hydrology) (NHC 2015).

Overall results indicate that:

- Geomorphic sub-reach 8 is at increased risk for systematic channel widening.
- Geomorphic sub-reaches 1 – 4 and 7 may also experience some systematic channel widening, but to a lesser extent then sub-reach 8.
- Sub-reaches 1-4 are bounded by relatively erosion resistant banks, which contributes significantly to the reduced erosion risk in these sub-reaches.
- Mid-range discharges (e.g. 20,000 – 100,000 cfs) may contribute to most of the channel widening for some locations along the lower American River.

Given authorized and funded implementation of the ARCF GRR erosion protection measures, and the consistency (<1 percent different) between the degradational/aggradational trends of No Action/No Project, the 2015 modeled with-project operation, and Alternative 2, modeled erosion rates expected under Alternative 2 are negligible. While the ARCF GRR erosion protection measures are being implemented over a longer time period (12 years), and the WCM operations update is scheduled to start water year 2018, there could be a damaging flow, rain event that occurs before a specific subreach's erosion protections measures are in place. However, ARCF GRR is not an in lieu of effort from the existing inspections and operations and maintenance actions, which would still be in place to address any short-term erosion issues. Therefore, effects to channel stability, seepage and erosion in the lower American River would not change as a result of Alternative 2 and any effects would be less than significant.

Folsom Lake Bank Erosion

As illustrated in Figure 4-15, the percentage of days with water surface elevations above 466 feet (NGVD) would be lower with the No Action/No Project condition (0.081 percent) than with Alternative 2 - Forecast-informed operations (0.270 percent). Also, the percentage of days with water surface elevations below 395 feet (NGVD) would be lower with Alternative 2 - Forecast-informed operations (8.343 percent) than with No Action/No Project (8.935 percent) (a difference of 0.592 percent).

This indicates that there would be a slight reduction in erosion rates along the banks of Folsom Lake with the implementation of Alternative 2 – Forecast-informed operations. Folsom Lake has water levels that routinely fluctuate. Water surface elevation fluctuations at Folsom Lake would remain within normal operating parameters. Overall, Alternative 2 - Forecast Informed Operations would result in water surface elevation patterns that are the same as or slightly higher than those with the No Action/No Project Condition. Therefore, there would be no effect or a slight benefit on Folsom Lake bank erosion.

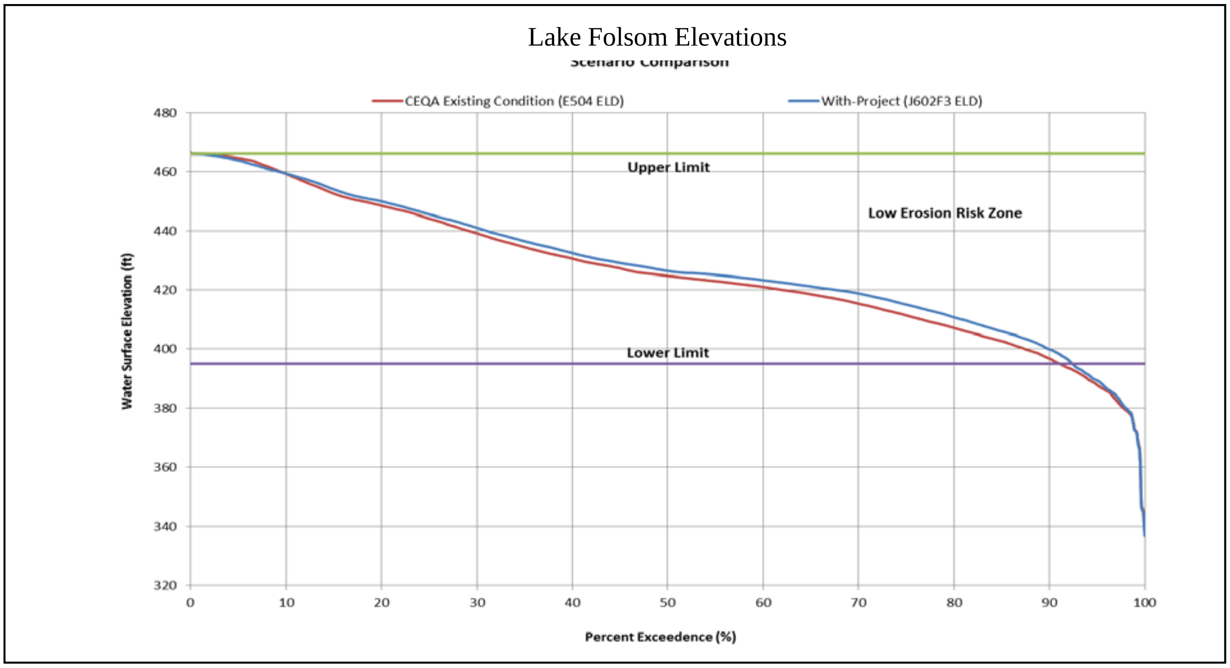


Figure 4-15. Folsom Lake Pool Levels Comparison of No Action/No Project Condition and Alternative 2 - Forecast-informed Operations.

Future Level of Demand

Alternative 2 model results were compared to the No Action/No Project condition, with an estimated future level of water demand within the regional effects assessment area through year 2033 applied to both CalSim model constructs (see Appendix A). This comparison allowed for a better understanding of additional effects which forecast-informed operations at Folsom might contribute to future resource conditions. A detailed explanation of how future levels of demand are represented in the CalSim II model is provided in Appendix A.

Hydrology

The probability that flows would be exceeded for the No Action/No Project future condition is rare. In this case, the percentage of the period or record that flows would exceed 20,000 cfs for the No Action/No Project future condition is 1.2 percent. Alternative 2 Future Condition flows would only deviate 2 percent from the No Action/No Project future condition (Figure 4-15), and the greatest benefits are gained for the rarest of events.

Channel Stability

Since modeled Folsom Dam releases are consistent between Alternative 2 and No Action/No Project under the future level of water demand forecasted conditions, the channel widening and degradation/aggradation trends discussed in Section 4.2 Alternative 2 Local Project Area would similarly apply to these future conditions as well.

Folsom Lake Bank Erosion

The Alternative 2 Forecast-informed Operations future condition was compared to the No Action/No Project future condition. The percentage of days with water surface elevations above 466 feet would be slightly higher with Alternative 2 (0.22 percent) relative to the No Action/No Project Alternative (0.03 percent). Also, the percentage of days with water surface elevations below 395 feet would be lower with Alternative 2 (11.22 percent) than with the No Action/No Project Alternative (12.40 percent). The difference is 1.18 percent. These differences are below the 5 percent threshold described in Section 4.1.7. A detailed discussion may be found in Appendix H.

Cumulative

The two cumulative projects in Table 4-2 have no negative operational effects. Implementation of the West Sacramento GRR project could have a beneficial effect of improving channel stability and reducing erosion and sedimentation. Overall, the cumulative effect is beneficial to no effect.

4.2.3 Mitigation

Differences between the existing and proposed Folsom Dam WCM operations do not surpass the thresholds of significance. Changes to flow conditions in the local and regional project areas are expected to be less than significant. Therefore, no mitigation is required.

4.3 Water Quality

This section primarily focuses on water quality in the Lower American River, and Delta outflow in the regional project area. Water temperature effects to fisheries are discussed in Section 4.5. The Water Quality discussion in Section 6 of the 2016 Coordinated Long Term Operation of the Central Valley Project and State Water Project EIS generally characterizes water quality parameters, TMDL's, 303(d) listing, and setting/existing condition for Folsom Reservoir, the Lower American River, and the regional project area for this resource.

4.3.1 Environmental Setting/Affected Environment

Local Project Area

The local project area is described in Section 2.1.1. Water temperature relative to its effects on fisheries is the main water quality issue. Lower American River water temperature is dependent on Nimbus Dam release temperatures, Folsom Dam peaking power operations, and draining or filling of Folsom Lake (Reclamation 2007). The operation of Folsom Dam and Reservoir directly affects lower American River water temperatures throughout much of the year, and resultant flow and water temperature patterns are sometimes inconsistent with the life cycle needs of anadromous salmonids in the lower American River (SWRI, 2001).

Additional water quality issues include sediments containing elemental mercury from historic mining operations as well as other metals from historic activities. However, results from a 2006 analysis of sediment samples from Folsom Reservoir indicated that none of the metal concentration levels exceeded any of the sediment standards, and as a result would be suitable for unconfined aquatic disposal (Reclamation, 2006). In the lower American River, the hydrology and hydraulics of the lower American River under Alternative 2 are similar to No Action/No Project hydrology and hydraulics, as discussed in section 4.2. Therefore, no significant changes in suspension of metals and contaminants in the lower American River are expected under Alternative 2.

Effects to riverine water temperature at locations throughout the CVP/SWP system are discussed in Fisheries and Aquatic Resources (Section 4.5). Therefore, there is no additional discussion of the water temperatures for the local project area in this section. With Reclamation's 2006 findings and the similarity in hydrology and hydraulics in the lower American River under Alternative 2 and No Action/No Project, the potential for changes in suspension of metals and contaminants in the local project area is considered to be less than significant and is not analyzed further. A detailed discussion of the water quality modeling approach and results can be found in Appendix B.

Regional Effects Assessment Area

The regional project is described in Section 2.1.2. The focus is on the Sacramento and Feather River's water quality and the Delta. Delta outflow is an important factor in determining water quality in the Delta. The Delta receives runoff from about 40 percent of the land area of California and consists of about 50 percent of California's total stream flow (DWR 2011). Water quality in the Delta is heavily influenced by a combination of environmental and institutional variables, including upstream pollutant loading, water diversions within and upstream of the Delta, and agricultural and other land use activities within the Delta. Critical Delta water quality parameters (i.e., temperature, turbidity, salinity and/or TDS, TOC, bromide, pathogens, temperature, nutrients, and other pollutants) can show considerable geographic and seasonal variation (DWR 2011). Flow rates, influenced by project operations and natural forces, are a primary determinant of water quality dynamics (DWR 2011). Salinity, bromide, and temperature in particular are closely related to changes in Delta inflows and outflows (SFEP 1992).

4.3.2 Environmental Consequences

Modification of the Folsom Dam WCD involves potential modifications of the reservoir's storage and release patterns. The timing and magnitude of those releases, in turn, affects water temperatures in the lower American River as well as the total freshwater inflow into the Delta – creating a secondary effect on the degree of salinity intrusion there. A third potential water quality effect modification of Folsom operations may have is to the salinity of water exported south of the Delta. Evaluation of the salinity of Delta exports will be addressed at a screening level through comparisons of Alternative 2 CalSim II model results for X2, total Delta inflow, and the E/I ratio to No Action/No Project CalSim II model results. Effects to riverine water temperature at locations throughout the CVP/SWP system are discussed in Fisheries and Aquatic Resources (Section 4.5). A detailed discussion of the water quality modeling approach and results can be found in Appendix B.

Methodology

CalSim II uses DWR's Artificial Neural Network (ANN) model to simulate the flow-salinity relationships for the Delta. The ANN model correlates Delta Simulation Model II (DSM2) model-generated salinity at key locations in the Delta with Delta inflows, Delta exports, and Delta Cross Channel operations.

<u>Net Delta Outflow Index</u>

The SWRCB D-1641 includes two Delta outflow criteria. The first is the Net Delta Outflow Index (NDOI). The NDOI is specified for all months in all water year types and establishes minimum Delta outflow requirements. Delta outflow is an important modeling component used in determining water quality in the Delta. A reduction in Delta outflow can result in greater seawater intrusion in the Delta that can affect the migration of estuarine species and the salinity level at water intakes. D-1641 provides the Net Delta Outflow Index (NDOI), minimum Delta outflow requirements for July through January, calculated as Delta inflow, minus net Delta consumptive use, minus Delta exports. Delta outflow objectives for July through January are presented in Table 4-9. For the rainy season from September through January, prior to water year type forecast, the CalSim II model uses the preceding year's water year type to compute the required Delta outflow.

Delta Export to Import Ratio

For February through June, the NDOI is a ratio of CVP/SWP exports from the Delta relative to inflow and is referred to as the export to inflow ratios or the E/I ratio. The regulatory requirement on limiting the E/I ratio was introduced in the 1995 WQCP and also implemented through D-1641. Higher inflows and lower export rates provide greater protection to the estuarine species. The maximum E/I ratio as stated in D-1641 is 65 percent for July through January and is 35 percent for February through June—the months most critical for fish species.

The E/I ratio limit for February can be relaxed depending on the Eight River Index, which accounts for the inflow of the eight major streams and rivers into the Bay-Delta system, for January. If the Eight River index is greater than 1.5 million acre-feet per year (MAF), the E/I ratio remains at 35 percent; if the index is lower than 1.0 MAF, the limit on E/I ratio is increased to 45 percent; finally, if the index is between 1.5 MAF and 1.0 MAF, the E/I ratio is set between 35 percent and 45 percent. Delta E/I ratio is generally built into the modeling assumptions for CalSim II and, therefore, the model restricts the exports based on this limit for all months of the year.

Table 4-9. Delta Outflow Objectives.

Month	**Minimum Delta Outflow (cfs)**
January	4,500 (6,000 if eight river index is >800 TAF)
February-June	X2 Standard
July	8,000 for wet and above normal years 6,500 for below normal years 5,000 for dry years 4,000 for critical years
August	4,000 for wet, above normal, and below normal years 3,500 for dry years 3,000 for critical years
September	3,000
October	4,000 for all except critical years 3,000 for critical years
November-December	4,500 for all except critical years 3,500 for critical years

Position of X2

The second outflow criteria is the position of X2, which is a salinity gradient position distance relative to the Golden Gate Bridge. The standard as implemented in D-1641 specifies that the location of X2 must remain west of the confluence of the Sacramento and San Joaquin Rivers, at Collinsville, measured 81 kilometer (km) upstream of the Golden Gate Bridge, for the months of February through June. A positive shift in the X2 location represents a condition where the alternative is farther east than the baseline, representing a poorer condition, and the magnitude of this change would be derived as a final derivative of the variation between the model outputs.

An electrical conductivity (EC) measurement at the Collinsville station (Node C2) of 2.64 millimhos per centimeter (mmhos/cm) is the parameter used during the February through June period. The most downstream location of this index value is commonly referred to as the position of "X2 in the Delta". The position of X2 is directly correlated to the NDOI and E/I ratio.

To evaluate the degree to which existing and with-project conditions meet these Delta water quality requirements, water quality output and Delta water diversions were extracted from the CalSim II models for the period of February through June in the 82-year POR runs. The diversions were then grouped by each water year type. The following indices were evaluated:

- The location of the X2 relative to River Km -64, - 75, and -81 during February through June.
- The X2 location for each WCM alternative, relative to the baseline condition.
- The relative change in monthly X2 position.

The average, maximum, and minimum monthly X2 position were then calculated for all months to compare the variability between the models, using a representation of the upper and lower boundaries of the data. The monthly shift in the X2 position was also evaluated on a year-to-year basis for each month in the 82-year POR.

Contra Costa Water District (CCWD) Rock Slough Intake

An evaluation of chloride concentrations at Rock Slough was completed, based on the monthly count of occurrences when Rock Slough chloride levels greater than 150 mg/L. A second comparison was also completed to consider the number of days that were less than 150 mg/L in each year and by water year type. A final comparison was then used to evaluate the magnitude of change when chloride exceeds 150 mg/L.

The Sacramento-San Joaquin Delta is the primary source of water for 500,000 residents of the CCWD in central and eastern Contra Costa County. CCWD water is drawn from Rock Slough near Oakley, Old River near the town of Discovery Bay, and Mallard Slough in Bay Point. CCWD's existing intakes are vulnerable to saltwater intrusion from the Bay in the late summer and fall months and during prolonged droughts. Water quality standards contained in D-1641 call for a minimum number of days that the mean daily chloride concentrations are less than or equal to 150 milligram per liter (mg/L). These standards are provided in Table 4-10.

Table 4-10. D-1641 Requirements for CCWD Rock Slough Intake Chloride Levels.

D-1641	Water Year Type				
	Wet	Above Normal	Below Normal	Dry	Critical
Minimum Number of Days Less than 150 mg/L Chloride	240	190	175	165	155
Percent Annual Occurrence	66 percent	52 percent	48 percent	45 percent	42 percent

Basis of Significance

Delta water quality standards and objectives have been promulgated through a series of SWRCB decisions, Water Rights Orders, and water quality control plans (WQCPs). As set forth in both the 2006 Bay-Delta Plan and D-1641 Standards, current Delta outflow requirements take two basic forms depending on water year type and season. The five parameters used are:

- Position of X2, representing the horizontal distance in kilometers up the axis of the estuary from the Golden Gate Bridge to where the tidally averaged near-bottom salinity is 2 parts per thousand. A X2 position east of the confluence of the Sacramento and San Joaquin Rivers (km 81) would be considered significant;
- Specific numeric Delta outflow requirements;
- CCWD's 150 mg\L standard per water year type
- Violate any local or regional water quality standards or waste discharge requirements; or
- Otherwise substantially degrade regional or local water quality.

No Action/No Project

Under the No Action alternative, the new auxiliary dam and additional variable flood space would not be utilized. Release schedules associated with Folsom Lake and Dam would remain the same. Since the flood space in Folsom Lake Reservoir will be required to remain at a variable 400,000 acre-feet to 670,000 acre-feet, excess water will continue to be released prior to the start of flood season. During dry years, water will continue to be allocated based on current regulations. Existing issues with salt water intrusion into the Delta in dry years would continue due to water shortfalls.

Alternative 2 – Forecast Informed Operations with Variable Folsom Flood Control Space (400,000 af to 600,000 af)

Net Delta Outflow

For long-term average Delta outflow comparisons, as well as comparisons of Delta outflow averages by water year type, Table 4-11 shows generally similar long-term average Delta outflows and generally similar average Delta outflow most of the time during all water year types in the range of ±2.0 percent. The magnitude of differences in Delta outflow is within a range of ±1.0 percent for the full simulation period average. As detailed in Appendix B, a maximum reduction of 2.0 percent occurred in the monthly water year type metric in March of dry water years. Average March through May outflow shows little increase of 0.7 percent over the full simulation period with a maximum of 0.5 percent reduction observed in March through May in dry water years.

Table 4-11. Comparison of long-term and water year type average Delta Outflow results for Alternative 2-Forecast-Informed Operations and No Action/No Project.

Evaluation Parameters	Water Year Type					
	Long-term	Wet	Above Normal	Below Normal	Dry	Critical
Monthly Maximum Reduction	√	–1.1 %	–1.7 %	–1.3%	–2.0%	√
Delta Outflow March–May	√	√	√	√	√	√
Delta Outflow Objectives	NA	√	√	√	√	√

Note: "✓"refers to same or similar values, generally representing a less than 1-percent difference in parameters.

For long-term average and water year type average E/I Ratio, model result comparisons show that Alternative 2 conditions would be generally similar for long-term averages and generally similar most of the time during all water year types, as indicated in Table 4-12. As detailed in Appendix B, maximum change seen is ±4.1 percent in dry year types. Long-term average monthly E/I ratios show a maximum absolute difference of 0.2 percent for June. All other months show very little absolute difference in the range of ±0.1 percent. The relative difference ranges from –1.2 percent in average of all Aprils to 0.9 percent in average of all Junes.

Table 4-12. Comparison of long-term and water year type average E/I Ratio for Alternative 2-Forecast-Informed Operations and No Action/No Project.

Evaluation Parameters	Water Year Type Average Range of Differences					
	Long-term	Wet	Above Normal	Below Normal	Dry	Critical
E/I Ratio	–1.2% to +0.9%	±1.9%	–1.7% to +0.8%	–1.2% to +1.1%	–1.0% to +4.1%	–1.7% to +1.0%

Note: "✓"refers to same or similar values, generally representing a less than 1-percent difference in parameters.

X2 Position

As indicated in Table 4-13 and Table 4-14, the Delta X2 location in general also shows minimal difference for the two modeled operations. Long-term average and by water year type differences are typically ±0.1 km or less, with a maximum of 0.2 km positive shift in average of March of dry years. The maximum monthly change ranges from 0.2 km in September to 1.2 km in December. Minimum monthly change observed ranges from –0.1 km in August to –3.1 km in June.

The average X2 for Alternative 2 moves east of the control point on two occasions relative to the No Action/No Project: at the 74 km control point in one year in June of below-normal years, and in one year east of the 64 km control point in April of dry years. The number of months of X2 moving east of the 74 km control point for Alternative 2 - Forecast-informed Operations relative to No Action/No Project decreases by one in May of dry water years. Results indicate that the scenarios are consistent with respect to the fall X2 standards. Both alternatives have X2 locations greater than those required by September standards while meeting October X2 standards (i.e. X2 moves west).

Table 4-13. Long-term and water year type average X2 location model results comparing Alternative 2-Forecast-Informed Operations and the No Action/No Project.

Summary of Findings	Evaluation Parameters	Water Year Type					
		Long-term	Wet	Above Normal	Below Normal	Dry	Critical
	X2 Location (km)	±0.1	–0.2 to +0.1	–0.2 to +0.1	–0.2 to +0.1	–0.1 to +0.2	±0.1
	X2 Location Counts East of 81 km	NA	√	√	√	√	√
	X2 Location Counts East of 74 km	NA	√	√	1 (June)	–1 (May)	√
	X2 Location Counts East of 64 km	NA	√	√	√	1 (April)	√

Note: "✓"refers to same or similar values, generally representing a less than 1-percent difference in parameters.

Both scenarios meet the Delta outflow objectives for July through January. The X2 for Alternative 2 - Forecast-informed Operations shows four instances with a greater than or equal to 1 km shift (east) and those occurred in March, April, November, and December. It is anticipated that with the overall increase of Folsom Lake conservation storage, operators would have sufficient flexibility to help minimize these shifts of the X2 for March, April, November, and December.

Contra Costa Water District

As summarized in Table 4-15, modeling results for Rock Slough chloride parameters show generally similar long-term average values and generally similar values most of the time during all water year types. The CCWD Rock Slough intake shows no increases in occurrences of chloride levels at greater than 150 mg/L levels. These occurrences show a one-time decrease in October of below-normal and dry water years and in September of critical water years. There was a maximum difference in chloride increase in one modeled below-normal water year of171.79 mg/L to 184.35 mg/L. Detailed modeling results and discussions on chloride changes at Rock Slough can be found in Appendix B.

Table 4-14. X2 Location changes (monthly maximum, monthly minimum, relative, and exceeding fall standards).

X2 Location	Evaluation Parameters	
Long-term and water year type average X2 Location – Generally similar long-term average and generally similar most of the time during all water year types. The maximum change is seen in December (1.2 km).	Change in X2 Location Monthly Maximum Value km	0.3 west (Feb)
	Change in X2 Location Monthly Minimum Value km	0.4 east (Dec)
	X2 Location Relative Change km (Maximum)	1.2 (Dec)
	X2 Location Relative Change km (Minimum)	–3.1 (Jun)
	X2 Exceeding Fall Standards (Count)	√
	X2 Location Shift	**Count**
	> or = 1 km	4
	0.5–1.0 km	14
	0.25–0.5 km	27

Note: "✓"refers to same or similar values, generally representing a less than 1-percent difference in parameters.

Table 4-15. Rock Slough Salinity.

Salinity Rock Slough	Evaluation Parameters	Long-term	Wet	Above Normal	Below Normal	Dry	Critical
	Salinity Rock Slough (Change in Count >150 mg/L)	NA	√	√	o	o	o
	Salinity Rock Slough Max Change (>150 mg/L: 12.56 mg/L)						

Note: "✓"refers to same or similar values, generally representing a less than 1-percent difference in parameters.
Note: "o" refers to a decrease in the count of occurrences of greater than 150 mg/L salinity at Rock Slough.

Future Level of Demand

Water quality modeling indicates that, in general, there is little difference between Alternative 2 operations and the No Action/No Project under future conditions. A detailed explanation of how future levels of demand are represented in the CalSim II model is provided in Appendix A.

Net Delta Outflow Index

The magnitude of differences in Delta outflow is within a range of ±1.0 percent for the full simulation period average monthly outflow. Specific months and water years indicate a long-term average decrease of 1.6 percent in March in dry water years. However, there is an overall 0.7 percent increase in March through May outflow and a 0.6-percent reduction observed in dry water years. Long-term average monthly E/I ratios show a maximum absolute difference in the range of –0.2 to +0.1 percent.

Position of X2

Overall, the X2 location in general also shows minimal difference for the two scenarios. Long-term average changes –0.1 km (west) for May through July, and 0.1 km (east) for March. All other months show no changes in long-term average X2 location. X2 location is similar for most months for all water years, with more negative shifts up to 0.3 km (east) and a few positive shifts of 0.1 km (west). The maximum year-to-year change for each month in the 82-year POR ranged from 0.3 km (east) in August to 1.2 km (west) in December.

Both scenarios meet the Delta outflow objectives for July through January and have average X2 locations greater than those required by September standards while meeting October X2 standards (i.e. X2 moves west). The X2 for Alternative 2 - Forecast-informed Operations Future Condition scenario has four instances with a greater than or equal to 1 km shift (east): twice in April, once in March and December. Although these shifts would indicate Alternative 2 - Forecast-informed Operations Future Condition would be "not consistent" with No Action/No Project future condition, these differences are considered less than significant because of the small increase in occurrences of these shifts relative to the number of years considered in the period of record.

Contra Costa Water District

The CCWD Rock Slough intake occurrences of chloride levels at greater than 150 mg/L levels show an increase in average chloride in one year in September of critical water years and a decrease in average chloride in one year in October of below-normal water years. Although

Alternative 2 - Forecast-informed Operations future condition would be considered “not consistent” with the No Action/No Project future condition because of the single occurrence of increased chloride, the effect would be considered less than significant because of the similar results for all other water year types.

Cumulative

The two cumulative projects in Table 4-2 have no operational effects on water quality. Implementation of the West Sacramento Flood Control project could have water quality impacts associated with construction. However, implementation of standard BMP’s through issuance of a 401 Water Quality Certification and SWPPP would reduce these effects. Overall, the cumulative effect is less than significant.

4.3.3 Mitigation

With less use of the variable space flood storage and greater capacity to capture spring-refill, Alternative 2 would be consistent with current operations in the American River and would not substantially degrade or cause a violation in the local water quality standards or waste discharge requirements. Alternative 2 provides Reclamation more flexibility in managing conservation storage to meet regional water quality requirements in the Delta than does the No Action/No Project operations. Model results show a range of monthly and water year impacts that can be both beneficial (position of X2 moves west) and adverse (eg. CCWD’s 150 mg\L metric shows a one-time decrease in October of below-normal and dry water years and in September of critical water years).

Overall, model results are less than the 5 percent threshold for the measurable metrics (eg. NDOI, X2, CCWD). Alternative 2 provides greater potential for stored water to be managed to meet Delta water quality standards than does the No Action/No Project condition. Therefore, effects to Delta water quality would be considered negligible to beneficial. No mitigation for water quality effects would be required as a result of implementation of Alternative 2.

4.4 Vegetation and Wildlife

This section describes the existing vegetation and wildlife in the local project area, including special status plant and animal species that have the potential to occur within the local project area. Also discussed are the methods by which effects were determined, the basis of significance, and the environmental consequences to vegetation and wildlife as a result of the Manual Update. Detailed discussions about the terrestrial resources effects assessment methodology and analysis results for the local project area is included in Appendix C.

The Terrestrial Biological Resources discussion in Section 10 of the 2016 Coordinated Long Term Operation of the Central Valley Project and State Water Project EIS generally characterizes the regional project area’s existing condition for this resource, which includes discussion of invasive species. Changes to vegetation and wildlife in the regional effects assessment area are not expected to be substantial given the minimal overall changes in flow, storage, and inundation duration that would occur under Alternative 2. Alternative 2 is not expected to change the distribution of vegetation or alter riparian vegetation within the project area, therefore it is not expected to contribute to the spread of invasive species. See Hydrology and Hydraulics, and Water Supply and Deliveries discussions under Section 4.2 and 4.6 for an evaluation of flow and storage. Therefore, regional effects on vegetation and wildlife resources were not evaluated further.

4.4.1 Environmental Setting/Affected Environment

The information provided in this section describes the vegetation and wildlife that occur near the Folsom Reservoir and the lower American River. Sacramento County's 2008 American River Parkway Plan (ARPP) provides a holistic discussion on the lower American River habitat types and species. The Biological Resources discussion in Section 4.4.5 of the 2010 Folsom Lake State Recreation Area and Folsom Powerhouse State Historic Park General Plan/Resource Management Plan EIS/EIR (Folsom GP/RMP) generally characterizes the existing condition for the local project area around Folsom and Nimbus dams and reservoirs. This section provides a general summary of current information and identifies resources to be evaluated.

A listing of Federally- and State-proposed, candidate, threatened, or endangered species (listed species) and their associated critical habitat was reviewed for the project area (USFWS 2017 and California Natural Diversity Database (CNDDB) 2017), as indicated in Appendix C.

<u>Lower American River</u>

The lower American River project area extends 29 miles from Nimbus Dam to the confluence with the Sacramento River and spans the width between levees on the north and south sides of the river. The 2008 ARPP documents that this area contains a diverse assemblage of vegetation communities: riparian, freshwater marsh, oak woodland, grassland, oak grassland and shrub grassland. These habitat communities support more than 220 birds and 30 mammal species including multiple special status and listed species.

Cottonwoods and willows (*Salix sp.*) are predominate in the riparian zone within the river floodplain, while shrub and vine thickets often grow immediately adjacent to sand bars or along the bank (ARPP 2008). Other species associated with this habitat include poison oak, wild grape (*Vilis californica*), blackberry (*Rubus ursinus*), northern California black walnut (*Juglans californica var. hindsii*), and white alder (*Alnus rhombifolia*). Alder-cottonwood forest is typical of the steep, but moist banks along much of the lower American River corridor. Valley oak woodland occurs on upper terraces composed of fine sediment where soil moisture provides a long growing season. Valley oak (*Quercus lobata*) is the dominant tree species in these areas. Live oak woodland occurs in the more arid and gravelly terraces that are isolated from the fluvial dynamics and moisture of the river. Non-native grassland commonly occurs in areas that have been disturbed by human activity and can be found on many of the sites within the river corridor.

Backwater areas and off-river ponds that are recharged during high flows support emergent wetland vegetation. These habitat areas are located throughout the length of the lower American River, but occur more regularly downstream of the Watt Avenue bridge. Plant species that dominate this habitat type include various species of willow, sedge (*Carex sp.*), cattail (*Typha* *sp.*), bulrush (*Scirpus sp.*), rush (*Juncus sp.*), barnyard grass (*Echinochloa crusgalli*), slough grass (*Paspalum dilatatum*), and lycopus (*Lycopus americanus*).

Wetlands and other waters of the U.S. were estimated for the lower American River within the bounds of the water surface elevation of a 160,000 cfs flow. Acreages for these water bodies were based on detailed land cover maps developed by DWR for their basin-wide feasibility studies for the major sub-basins of the Sacramento River and San Joaquin River Watersheds (DWR 2011). Wetlands in the local project area include limited areas of freshwater marsh and seasonal wetlands typically located within or adjacent to streams, swales, or other drainages. Other waters of the U.S. include the American River and two unnamed tributaries to the American River.

<u>Folsom Reservoir and Nimbus Reservoir (Lake Natoma)</u>

Stands of native vegetation occupy much of the area adjacent to the shoreline of Folsom Reservoir. Habitats associated with these lakes include blue oak-grey pine woodland, oak woodland, chaparral, and annual grassland, with the area surrounding Folsom Reservoir dominated by blue oak-grey pine woodland (USFWS 2001). The lake shoreline fluctuation zone is barren band (the drawdown zone) in an arrested successional stage due to seasonal water level changes. Quickly colonized by forbs, wildflowers, and non-native grasses when water levels decline, this “band” can provide additional foraging area for open habitat type species. There are no special status species associated with the shoreline.

Lake Natoma is a regulating reservoir, and as such, fluctuates on a daily basis regardless of season. The Manual Update is not expected to impact vegetation and wildlife resources around the lake. Therefore, Lake Natoma is not considered for additional analysis.

The area around Folsom reservoir supports an animal community characteristic of the lower Sierra Nevada western slope. Although the range of elevation is small, habitats are diverse, in part because the reservoir extends about 20 miles into the Sierra Nevada foothills, from gentle hills near the dam to steep-walled canyons along the forks of the American River. Seasonally wet areas outside the reservoir receive water from seeps, drainages and from direct precipitation. Dominant species in these areas include pointed rush, Baltic rush, and often scattered willow and cottonwood. During the dry season, these areas support annual upland vegetation such as non-native brome grasses and other forbs.

<u>Special Status Species</u>

Based on known occurrences and quality of existing habitat, a total of seven plant species and sixteen special-status animal species have potential to occur in the project area (Table 4-16 and Table 4-17). A table of all special-status species reported from the project vicinity and an evaluation of their potential to occur is provided in Appendix C.

Table 4-16. Federally and State-Listed Plant Species with the Potential to Occur in or near the Local Project Area[1].

Common Name	Scientific Name	Federal Status	State Status
Boggs Lake hedge-hyssop	*Gratiola heterosepala*	None	Endangered
El Dorado bedstraw	*Galium californicum ssp. Sierra*	Endangered	Rare
Layne's ragwort	*Packera layneae*	Threatened	Rare
Pine Hill ceanothus	*Ceanothus roderickii*	Endangered	Rare
Pine Hill flannelbush	*Fremontodendron decumbens*	Endangered	Rare
Sacramento Orcutt grass	*Orcuttia viscid*	Endangered	Endangered
Stebbins' morning-glory	*Calystegia stebbinsii*	Endangered	Endangered

[1]USGS quads: Rocklin, Pilot Hill, Citrus Heights, Folsom, Clarksville, Sacramento West, Sacramento East, and Carmichael.
Source: CNDDB, 2018.

4.4.2 Environmental Consequences

Methodology

Period of record water surface elevations were calculated for all Folsom Dam flood operation scenarios that were evaluated. Water surface elevations and flow were modeled for the lower American River and Folsom Lake using CalSim II, HEC-RAS and ResSim. Changes in water surface elevations and flow below thresholds needed to maintain the frequency of inundation of reservoir and riverine shorelines, riparian terraces, and backwaters ponds were evaluated to identify significant effects to terrestrial resources.

Cottonwood dominated riparian and backwater, off-river ponds are diverse habitats supporting a high species diversity and richness. Because both are dependent on elevation and flow factors, evaluating the effect of an action on each provides a method to assess site specific and overall system and species impacts. For example, cottonwood seed germination, dispersal, and tree establishment is linked to timing and duration of flow events. Backwater pond recharge is more complex and includes timing and duration of flow events as well as factors such as soil permeability and existing vegetation.

Table 4-17. Federal and State-Listed Animal Species with the Potential to Occur in or near the Local Project Area[1].

Common Species	Status (Fed/State)	Habitats	MicroHabitat	Critical Habitat	Local Area Probability
Bald eagle *Haliaeetus leucocephalus*	-- / SE	Lower montane coniferous forest | Oldgrowth	Nests in large, old-growth, or dominant live tree w/open branches, especially ponderosa pine. Roosts communally in winter.	N/A	high foraging, overwinter
California black rail *Laterallus jamaicensis coturniculus*	-- / ST	Brackish marsh | Freshwater marsh | Marsh & swamp | Salt marsh | Wetland	Needs water depths of about 1 inch that do not fluctuate during the year & dense vegetation for nesting habitat.	N/A	moderate Folsom reservoir
Tricolored blackbird *Agelaius tricolor*	-- / CE	Freshwater marsh | Marsh & swamp | Swamp | Wetland	Requires open water, protected nesting substrate, & foraging area with insect prey within a few km of the colony.	N/A	high
Swainson's hawk *Buteo swainsoni*	-- / ST	Great Basin grassland | Riparian forest | Riparian woodland | Valley & foothill grassland	Requires adjacent suitable foraging areas such as grasslands, or alfalfa or grain fields supporting rodent populations.	N/A	low foraging
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	FT / SE	Riparian forest	Nests in riparian jungles of willow, often mixed with cottonwoods, w/ lower story of blackberry, nettles, or wild grape.	No	moderate migratory
Bank swallow *Riparia riparia*	-- / ST	Riparian scrub | Riparian woodland	Requires vertical banks/cliffs with fine-textured/sandy soils near streams, rivers, lakes, ocean to dig nesting hole.	N/A	high
Least Bell's vireo *Vireo bellii pusillus*	FE / SE	Riparian forest | Riparian scrub | Riparian woodland	Nests placed along margins of bushes or on twigs projecting into pathways, usually willow, Baccharis, mesquite.	No	moderate migratory
Vernal pool fairy shrimp *Branchinecta lynchi*	FT / --	Valley & foothill grassland | Vernal pool | Wetland	Inhabit small, clear-water sandstone-depression pools and grassed swale, earth slump, or basalt-flow depression pools.	No	low
Vernal pool tadpole shrimp *Lepidurus packardi*	FE / --	Valley & foothill grassland | Vernal pool | Wetland	Pools commonly found in grass bottomed swales of unplowed grasslands. Some pools are mud-bottomed & highly turbid.	No	low
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	FT / --	Riparian scrub	Prefers to lay eggs in elderberries 2-8 inches in diameter; some preference shown for "stressed" elderberries.	Yes	high
Giant gartersnake *Thamnophis gigas*	FT / ST	Marsh & swamp | Riparian scrub | Wetland	This is the most aquatic of the gartersnakes in California.	No	low

Basis of Significance

The following criteria were applied to evaluate significant effects to terrestrial resources caused by modification of flood risk reduction operations at Folsom Dam:

- Substantial change in frequency (≥5 percent) of monthly lower American River flows below 1,765 cfs (maintenance and radial growth of Cottonwoods), 2,000 cfs (growth of Cottonwoods), 2,700 cfs (recharge of backwater ponds), 3,000 cfs ((maximum growth and maintenance of Cottonwoods), 4,000 cfs (recharge of backwater ponds), 5,000 cfs (inundation of riparian terraces adjacent to and remote from the lower American River);.
- Substantial changes in frequency of exceedance of water surface elevations outside of the fluctuation zone at Folsom Lake ranging from elevation 384 feet to 466 feet (NGVD 1929).
- Substantial loss, degradation, or fragmentation of any natural vegetation communities.
- Substantial effects on a sensitive natural community, including riparian habitat and Federally-protected wetlands and other waters of the U.S., as defined by Section 404 of the Clean Water Act.

No Action/No Project

Under the No Action Alternative, Folsom Lake and Dam would continue to operate under the existing Interim Agreement. The new auxiliary dam would not be utilized except in extremely rare circumstances that threaten the structural integrity of Folsom Dam. Average peak flows, release rates and surface water levels would be expected to remain the same. Release schedules for Folsom Dam would remain the same. Folsom Lake would continue to be required to reduce the water conservation pool to a variable space 400,000 af to 670,000 af prior to the start of flood season. Vegetation and special status species in the Delta would continue to be influenced by the current flow regime. During dry water years, there would continue to be less cold water available to sensitive aquatic species. River levels would remain low during summer months. The upper banks and floodplains would continue to be inundated periodically during large storm events.

Alternative 2 – Forecast Informed Operations with Variable Folsom Flood Control Space (400,000 af to 600,000 af)

A general discussion of the results of the terrestrial resources affects assessment for Alternative 2 is included below. Detailed results of the model output analysis is included in Appendix C.

<u>Lower American River Cottonwood Growth</u>

To facilitate, growth on the lower American River, flows would be kept at or above 1,765 cfs and 3,000 cfs during the cottonwood growing season of March through October (Reclamation 2004). Thus, a decrease in the number of days flow is below this threshold is considered an improvement. In addition, for cottonwood seed dispersal and germination of new cottonwoods during February through April flows exceed should 5,000 cfs to 13,000 cfs in order to inundate higher terraces (USFWS 1996). Thus, an increase in the number days flow exceeds this threshold is also considered an improvement

Based on the modeled period of record hydrology comparisons, Alternative 2 would decrease the number of days that flows would be below 1,765 cfs in March through October by approximately 13 percent and the number of days that flows would be below 3,000 cfs by about 2 percent when compared to the No Action/No Project hydrology. Alternative 2 also saw about a 5-percent increase in flows that exceeded 5,000 cfs in February through April. Therefore, the lower American River flows with Alternative 2 - Forecast-informed operations would have a beneficial effect to no effect relative to the No Action/No Project on cottonwood growth. Because the effects are beneficial, there would be no loss, degradation, or fragmentation of any natural vegetation communities and no effects on a sensitive natural community, including riparian habitat and Federally-protected wetlands and other waters of the U.S., as defined by Section 404 of the Clean Water Act.

Lower American River Channel Widening

Section 4.3.2 fully analyzes the potential impacts of channel widening. As discussed in that section, modeled erosion rates expected under the proposed action are negligible, particularly after implementation of erosion control features from the ARCF GRR. Therefore, effects to channel stability in the lower American River would be negligible under the proposed action relative to the baseline condition and therefore would not significantly affect vegetation or wildlife along the lower American River. However, as described below under Special-Status Plant and Animal Species, Alternative 2 would include monitoring of erosion to ensure impacts to riparian habitat remain less than significant.

Lower American River Backwater Recharge

The winter (December, January, and February) and spring (March, April, and May) months are when backwater ponds closest to the river are recharged by high flows. Previous field studies conducted on the lower American River indicated that mean monthly flows between 2,700 cfs and 4,000 cfs were adequate to recharge the ponds closest to the river and more-distant off-river ponds, respectively (Sands et al. 1985).

Comparisons between Alternative 2 – Forecast-informed operations modeled hydrology and the No Action/No Project condition, showed the number of days below 2,700 cfs decreased slightly under Alternative 2 by about 2 percent in the December through May timeframe. In addition, the number of days with flows below 4,000 cfs decreased by about 1 percent under Alternative 2. Relative to the No Action/No Project Condition, Alternative 2 - Forecast Informed operations would result in a slightly lower number of days when average daily flows are below the thresholds during winter and spring. However, the occurrence of these flows would not be changed by sufficient magnitude and frequency to substantially alter the existing backwater habitats dependent on the lower American River. The modeling results are all less than the primary 5 percent modeling significance threshold. Therefore, affects to backwater recharge would be negligible to less than significant. Because the effects are negligible to less than significant, the corresponding effect to any natural vegetation communities and sensitive natural community would also be negligible to less than significant.

Folsom Lake

Modeled average daily water surface elevations for the No Action/No Project and Alternative 2 – Forecast-informed Operations are compared by month in Table 4-18 based on the full period of record hydrology and also by water year type.

With Alternative 2 - Forecast Informed Operations, the water surface elevation fluctuations at Folsom Lake would remain within normal operating parameters. It is not expected that water elevations would exceed the 466-foot-elevation (NGVD) threshold. Folsom Lake has water levels that routinely fluctuate. Alternative 2 - Forecast Informed Operations would result in water surface elevation patterns that are the same as or slightly higher than those with the No Action/No Project Condition. As a result, no change to the distribution of vegetation or alteration of riparian vegetation scattered around Folsom Reservoir would be expected. It is not expect this change in duration would alter vegetation around the reservoir. Effects to the terrestrial resources around Folsom Lake would be less than significant.

The following species from Table 4-16 – El Dorado bedstraw, Layne's ragwort, Pine Hill ceanothus, Pine Hill flannelbush and Stebbins' morning-glory – are typical of upland habitats. The species have been recorded in the region(s) to the south and southeast of Folsom Dam and reservoir. None of the species are likely to occur within the local or regional project areas affected by the Manual Update operations. Similarly, there is no critical habitat in the project area for giant gartersnake and the likelihood of it occurring in the local project area is low. Therefore, no adverse effects to these species have been identified.

USFWS has designated the American River Parkway as critical habitat for VELB, and this species has been recorded in elderberry shrubs in riparian habitat and near backwater ponds along the lower American River. Flows would not be reduced by sufficient magnitude and frequency to substantially alter existing water fluctuations (pond levels) and vegetation dependent on these ponds. Effects to backwater habitats with the Alternative 2 - Forecast-informed Operations alternative would be negligible. However, changes in mid-range flows may increase erosion rates during some years in the lower American River until ARCF erosion protection measures are implemented. Overall, it is expected that effects on elderberry shrubs would be less than significant. Elderberry shrubs that would be established at Folsom Reservoir would exist above the fluctuation zone and would not be affected by proposed changes to flood management operations under Alternative 2. In addition, the Manual Update Alternative 2 is expected to have negligible to beneficial effects on cottonwood growth, which is an associated species for elderberry shrubs and VELB.

Table 4-18. Folsom Reservoir Average Daily Elevations under No Action/No Project (E504 ELD) and Alternative 2 - Forecast-informed (J602F3 ELD) Operations.

	Average Elevation (feet msl)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period[2]												
No Action/No Project (E504 ELD)	419	412	409	410	413	419	433	447	451	443	433	425
With-Project (J602F3 ELD)	419	412	410	413	417	424	436	448	452	444	433	426
Difference	0	0	1	3	4	5	3	1	1	1	0	1
Percent Difference[3]	0.0	0.0	0.2	0.7	1.0	1.2	0.7	0.2	0.2	0.2	0.0	0.2
Water Year Types[1]												
Wet												
No Action/No Project (E504 ELD)	423	415	415	415	416	420	438	456	464	461	453	442
With-Project (J602F3 ELD)	423	416	417	421	425	430	441	457	464	460	453	443
Difference	0	1	2	6	9	10	3	1	0	-1	0	1
Percent Difference	0.0	0.2	0.5	1.4	2.2	2.4	0.7	0.2	0.0	-0.2	0.0	0.2
Above Normal												
No Action/No Project (E504 ELD)	414	407	402	410	415	422	439	456	463	454	443	433
With-Project (J602F3 ELD)	414	407	404	414	422	429	443	457	463	453	444	434
Difference	0	0	2	4	7	7	4	1	0	-1	1	1
Percent Difference	0.0	0.0	0.5	1.0	1.7	1.7	0.9	0.2	0.0	-0.2	0.2	0.2
Below Normal												
No Action/No Project (E504 ELD)	421	416	412	414	419	426	439	454	459	449	437	434
With-Project (J602F3 ELD)	421	416	412	414	420	428	441	456	460	449	438	435
Difference	0	0	0	0	1	2	2	2	1	0	1	1
Percent Difference	0.0	0.0	0.0	0.0	0.2	0.5	0.5	0.4	0.2	0.0	0.2	0.2
Dry												
No Action/No Project (E504 ELD)	419	412	409	409	413	421	433	443	444	432	419	414
With-Project (J602F3 ELD)	419	411	408	409	413	423	436	446	446	434	420	415
Difference	0	-1	-1	0	0	2	3	3	2	2	1	1
Percent Difference	0.0	-0.2	-0.2	0.0	0.0	0.5	0.7	0.7	0.5	0.5	0.2	0.2
Critical												
No Action/No Project (E504 ELD)	411	404	400	397	397	404	411	415	415	407	396	388
With-Project (J602F3 ELD)	412	405	400	397	398	404	411	415	415	407	395	388
Difference	1	1	0	0	1	0	0	0	0	0	-1	0
Percent Difference	0.2	0.2	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	-0.3	0.0

1 As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995)

2 Based on the 81-year simulation period

3 Relative difference of the monthly average

To ensure that the effects to VELB do not become significant or exceed the take allowed in the USFWS BO issued in October 2018, events with discharges that exceed 60,000 cfs shall be monitored to determine the amount of erosion and habitat loss that occurs in the lower American

River (Appendix K). A report documenting the estimated amount of take associated with any habitat loss will be provided to USFWS. Monitoring would cease if the results show that temporary habitat losses in subreach 7 & 8 do not exceed 70% of the allowable take and if after reinspection of the eroded areas after 5 years shows that at least 50% of the area has revegetated naturally.

Special-Status Plant and Animal Species

The riparian corridors that occur throughout the local and regional project area could provide potential habitat for yellow-billed cuckoo (YBCU). As discussed above, flows would not be altered sufficiently enough to alter existing riparian forest or vegetation. Because any effects from the proposed changes in operations from Alternative 2 would be negligible to the overall function of riparian habitat within the project area, effects to YBCU would be less than significant.

The change in operation is not anticipated to substantially impact any existing wetlands or vernal pools or their associated species since backwater recharge rates are expected to remain fairly similar to the no action condition. Thus, there are no effects to the vernal pool dependent plant species – Boggs Lake hedge-hyssop and Sacramento Orcutt grass. Additionally, given the minor changes to existing conditions, operational changes are not expected to impact any avian species. Habitat conditions for birds would remain generally the same. Similarly, there is no critical habitat in the project area for giant gartersnake and the likelihood of gartersnakes occurring in the local project area is low. Changes to flow regime would not significantly alter the availability of gartersnake habitat for any snakes that may be present. Therefore, overall impacts on species identified in Table 4-17 would be less than significant.

Future Level of Demand

Cottonwood Growth

Relative to the No Action/No Project future condition, Alternative 2 - Forecast-informed Operations future condition results indicate that the lower American River flows under the 1,765-cfs threshold could decrease between 1.7 to 3.3 average days per month over a 3-consecutive-month period during the cottonwood growing season. This change could provide additional flows for cottonwood radial growth and provide a potential benefit during the cottonwood growing season. Under the 3,000-cfs threshold comparison, cottonwood growth would stay relatively consistent between Alternative 2 - Forecast-informed Operations future condition and No Action/No Project future condition. Therefore, effects on vegetation growth with Alternative 2 - Forecast-informed Operations future condition would be negligible to beneficial. In addition, there would be no substantial difference in the pattern of peak flows needed to inundate terraces for cottonwood dispersal and regeneration between Alternative 2 - Forecast-informed Operations future condition and No Action/No Project future condition.

Backwater Recharge

Relative to No Action/No Project future condition, Alternative 2 - Forecast-informed Operations future condition would result in a minimal monthly change in the average number of days when average daily flows are below the thresholds during winter and spring. The difference does not surpass the 5 percent modeling threshold. Given the minimal difference between No Action/No Project future condition and Alternative 2 - Forecast-informed Operations future condition, average duration and timing of flows remains similar and will not substantially alter the existing backwater habitats dependent on the lower American River.

Folsom Reservoir

With Alternative 2 - Forecast-informed Operations future condition, the water surface elevation fluctuations at Folsom Reservoir would remain within normal operating parameters (i.e., it is not anticipated that water elevations would exceed the 466 foot-msl threshold or barren band for durations that could affect existing vegetation). Alternative 2 - Forecast-informed Operations future condition would result in water surface elevation patterns that are the same as or slightly lower than those with No Action/No Project future condition. Therefore, the 5 percent threshold is not exceeded and the effect is negligible in the short and long-term.

Special Status Plant and Animal Species

Because effects on cottonwood growth and backwater habitats with Alternative 2 - Forecast-informed Operations future condition would be negligible to beneficial, effects on elderberry shrubs and special-status species that depend on these habitats would also be the same. Additionally, the implementation of monitoring for effects from erosion due to mid-range flow events would ensure effects remain less than significant.

Alternative 2 - Forecast-informed Operations future condition would not change the distribution of vegetation or alter riparian vegetation scattered around Folsom Reservoir. The fluctuation zone at Folsom Reservoir is essentially devoid of vegetation with typical elevations levels ranging from 384 to 465 feet msl. This duration is not expected to alter vegetation around the reservoir. Under these conditions, any elderberry shrubs that would be established at Folsom Reservoir would exist above the fluctuation zone and would not be adversely affected by the flood-control project operations.

Cumulative

Two foreseeable cumulative projects each has a potential different effect on the local project area in conjunction with the Manual Update. The Folsom Dam Raise project would result in negligible to beneficial effects downstream on lower American River vegetation and wildlife resources. The ability to use the dam's auto shutters would improve ability to meet downstream, cold-water temperature requirements. Around Folsom Reservoir, the increase in surcharge space could raise water surface elevations and effect vegetation. However, this effect is considered less than significant in the short-term because of the frequency of occurrence being in the range of a 1 in 200 to 1 in 400 annual chance event. Long-term effects would be negligible for this same reason.

The West Sacramento Flood Control projects could affect the American River confluence with the Sacramento River. This project could have a beneficial effect through the reduction of erosion and sedimentation, which impact riparian and aquatic habitats alike.

Overall, these two projects would have a negligible to less than significant impact in conjunction with the Manual Update.

4.4.3 Mitigation

No mitigation is required since Alternative 2 would not change the distribution or alteration of riparian vegetation or significantly affect special-status plant and animal species. However, as mentioned above, monitoring of events with discharges above 60,000 cfs would occur to ensure impacts to VELB do not exceed the allowable take as defined in the USFWS BO (Appendix K).

4.5 Fisheries

Special-status fish species considered in this document are those that are Federally or State-listed as threatened or endangered, species that are proposed for Federal or State listing as threatened or endangered, species classified as candidates for future Federal or State listing, Federal species of concern, or State species of special concern.

Special emphasis has been placed on these fish species of focused evaluation to facilitate compliance with applicable laws, particularly the Federal and State Endangered Species Acts (ESA), and to be consistent with Federal and State restoration/recovery plans and NMFS and USFWS Biological Opinions. This focus is consistent with:

- The NMFS (2009) Biological Opinion and Conference Opinion on the Long-Term Operations of the Central Valley Project and State Water Project;
- The NMFS (2014) California Central Valley Salmon and Steelhead Recovery Plan;
- CALFED's (2000) Ecosystem Restoration Program Plan and Multi-Species Conservation Strategy;
- The programmatic determinations for the CALFED Bay-Delta Program, which include the California Department of Fish and Wildlife's (CDFW) Natural Community Conservation Planning Act (NCCPA) approval and the programmatic biological opinions issued by NMFS and USFWS;
- USFWS's 2001 Final Restoration Plan for the Anadromous Fish Restoration Program (AFRP), which identifies specific actions to protect anadromous salmonids;
- CDFW's 1996 Steelhead Restoration and Management Plan for California, which identifies specific actions to protect steelhead;
- Sacramento County's American River Parkway Plan (Sacramento County 2008);

- CDFW's Restoring Central Valley Streams: A Plan for Action (CDFW 1993), which identifies specific actions to protect salmonids. Improvement of habitat conditions for these fish species of focused evaluation could protect or enhance conditions for other fish resources, including native resident species.
- California Natural Resources Agency (CNRA)'s 2017 Sacramento Valley Salmon Resiliency Strategy, which addresses specific near- and long-term needs of Sacramento River salmon. The Strategy relies heavily on the NMFS 2014 recovery plan;
- CNRA's 2016 Delta Smelt Resiliency Strategy, which addresses near- and long-term needs of Delta smelt to promote resiliency to drought conditions as well as future variations in habitat conditions; and
- USFWS's 1996 Sacramento-San Joaquin Delta Native Fishes Recovery Plan, which identifies actions required to recover and/or protect listed species.

4.5.1 Environmental Setting/Affected Environment

Local Project Area

<u>Lower American River</u>

The local project area includes the approximate 23 river miles of the lower American River extending from Nimbus Dam to the confluence with the Sacramento River. Details regarding fisheries resources and aquatic habitat in the lower American River are provided below.

The lower American River Watershed supports more than 40 species of native and nonnative fish. There are currently seven special-status fish species in the lower American River, as listed in Table 4-19. Also included are 2 species of recreational importance, American shad and striped bass. An incidental capture of a juvenile white sturgeon in a rotary screw trap near Watt Avenue in 2014 is indicative of some level of white sturgeon rearing on the American River. However, for purposes of this analysis, the focus of affects to white sturgeon is on the Sacramento River, the white sturgeon's primary rearing area.

<u>Folsom Reservoir and Lake Natoma</u>

Folsom Reservoir inundates approximately 12,000 acres of the North Fork, South Fork, and main stem of the American River. Although the maximum depth of the reservoir is 266 feet just behind Folsom Dam, most of the reservoir is shallower averaging 66 feet in depth. The waters of Folsom Reservoir stratify in the warmer months from April through November, with a layer of warmer water known as the epilimnion sitting on top of a bottom layer of cold water known as the hypolimnion.

Table 4-19. Special-Status Fish Species and Fish of Recreational Importance in the Lower American River.

Common Name	Status
• Central Valley steelhead	Federal threatened
• Central Valley fall-run Chinook salmon [a]	Federal species of concern State species of special concern Recreational and/or commercial importance (hatchery origin)
• Central Valley late fall-run Chinook salmon [a]	Federal species of concern Recreational and/or commercial importance (hatchery origin)
• Central Valley spring-run Chinook salmon (non-natal rearing only)	Federal and State threatened
• Western River lamprey	State species of special concern
• Pacific lamprey	State species of special concern
• Sacramento splittail	State species of special concern
• Hardhead	State species of special concern
• American shad	Recreational and/or commercial importance
• Striped bass	Recreational and/or commercial importance

Note: Although the official designation of the Evolutionarily Significant Unit is Central Valley fall-/late fall-run Chinook salmon, the evaluation is for fall-run Chinook salmon on the lower American River because of the absence of late fall-run Chinook salmon.

Habitat within Folsom Reservoir allows for a diverse assemblage of native and introduced fish species to coexist. Folsom Reservoir is managed as a ‘two-story’ fishery, with cold water fishes such as trout inhabiting the hypolimnion and warm-water fishes such as bass and sunfish inhabiting the epilimnion and shoreline areas. Two cold water fisheries for rainbow trout and Chinook salmon are actively maintained through a stocking program. Anadromous fish, such as Chinook salmon and steelhead do not ascend the river beyond Nimbus Dam. The Nimbus Hatchery was constructed as a mitigation hatchery for the original Folsom Dam Project.

Native and introduced fishes are present in the Folsom Reservoir area. Native fishes occur primarily as a result of their continued existence in tributaries of Folsom Reservoir and Lake Natoma. Two native species are planted in Folsom Reservoir for fishing, rainbow trout and Chinook salmon. The populations of most other species are currently self-supporting. Introduced fishes are more commonly found in the reservoirs than are native fishes. Most of these fishes were introduced into the State as game fish or as forage fish to support game fish populations.

Native species that occur in the reservoir include hardhead and Sacramento pikeminnow. However, introduced largemouth bass, smallmouth bass, spotted bass, bluegill, crappie, and catfish constitute the primary warmwater sport fisheries of Folsom Reservoir. The cold water sport species present in the reservoir include rainbow and brown trout, kokanee salmon and Chinook salmon. Brown trout have been stocked into the reservoir in the past. Although they are no longer stocked, a population of brown trout remains in the reservoir. Rainbow trout are stocked in Folsom Reservoir by CDFW at multiple sizes, including catchable-size (2 fish/pound). Kokanee salmon are stocked as fingerlings. Chinook salmon stocked in Folsom Reservoir are reared at the Feather River Hatchery as part of CDFW's Inland Chinook Salmon Program. These species are stream spawners and, therefore, do not reproduce within the reservoir. However, some spawning by one or more of these species may occur in the American River upstream of Folsom Reservoir.

The reservoir's cold water pool is important not only to the cold water fish species identified above, but also is important to lower American River fall-run Chinook salmon and steelhead. Seasonal releases from the Folsom Reservoir's cold water pool provide thermal conditions in the lower American River that support annual in-river production of these salmonid species. Folsom Reservoir's annual cold water pool is not large enough to facilitate both cold water releases during the warmest months (i.e., July through September) to provide maximum thermal benefits to over-summer juvenile steelhead rearing in the lower American River, and cold water releases during October and November that would maximally benefit fall-run Chinook salmon immigration, spawning, and incubation. Consequently, management of the reservoir's cold water pool on an annual basis is essential to providing thermal benefits to both fall-run Chinook salmon and steelhead, within the constraints of cold water pool availability.

Lake Natoma supports many of the same fisheries found in Folsom Reservoir (rainbow trout, bass, sunfish, and catfish). Some recruitment of warm water and cold water fishes likely comes from Folsom Reservoir. In addition, CDFW stocks catchable-size rainbow trout in Lake Natoma annually. Although supporting many of the same fish species found in Folsom Reservoir, Lake Natoma's limited primary and secondary production, colder epilimnotic water temperatures (relative to Folsom Reservoir), and daily elevation fluctuations are believed to reduce the size and annual production of many of its fish populations, relative to Folsom Reservoir (USFWS 1991). Lake Natoma's characteristics, coupled with limited public access, result in lower angler use compared to Folsom Reservoir.

Regional Effects Assessment Area

The Fisheries discussion in Section 9 of the 2016 Coordinated Long Term Operation of the Central Valley Project and State Water Project EIS generally characterizes the regional project area's fisheries resources and affected environment, which includes discussion of invasive species. The focus of Manual Update analysis is on the geographic areas in the Sacramento River and Feather River watersheds, and the Delta. Fish metrics and species impacts analysis are directly correlated to reservoir storage levels and river flow. CalSim II modeling presented in Section 4.2 and 4.6, indicates reservoir storage and river flows are equal to or less than 1 percent over the entire model period. Short and long-term effects are considered negligible to no effect and do not rise to a level of significance requiring additional analysis and discussion. Therefore, only a general summary of the regional effects assessment is discussed. See Appendix D for a detailed discussion of model results relative to WUA, Temperature, Redd dewatering, and species specific actions.

4.5.2 Environmental Consequences

Changes in the operation of Folsom Dam associated with the Manual Update have the potential to alter operation of several other CVP and SWP dams and reservoirs as well as pumping facilities in the South Delta. The potential changes in dam and reservoir operations could, in turn, alter flows and water temperatures below the dams, as well as hydrologic conditions in the Delta. The fisheries evaluation focused on these and other habitat-based elements. Taking into account species and life stage-specific habitat requirements, reservoir and dam operations associated with the Manual Update alternatives were also assessed to evaluate potential effects on identified fish species and associated aquatic habitat.

Although reservoir operations and associated changes in river flows and water temperatures could potentially affect many species, the evaluation focused on a subset of all species that could potentially be affected. Species of focused evaluation consisted of special-status fish species (Federal and State listed threatened and endangered, Federal candidate species and species of concern, and State species of special concern), as well as other recreationally important species (e.g., striped bass and American shad). Species of focused evaluation are identified for specific geographic areas based on the potential for lacustrine, riverine, or estuarine habitat to be affected. Fish species included in the focused evaluation are listed in Table 4-20.

Table 4-20. Fish Species included in the Focused Evaluation of Fisheries Effects.

Species	**Status**
Cold water reservoir species	Recreational and/or commercial importance
Warmwater reservoir species	Recreational and/or commercial importance
Central Valley spring-run Chinook salmon	Federally and State threatened
Central Valley fall/late fall-run Chinook salmon	Federal species of concern, State species of special concern, Recreational and/or commercial importance
Central Valley steelhead	Federally-threatened; Recreational and/or commercial importance
Southern DPS of North American green sturgeon	Federally-threatened; State species of special concern
Hardhead	State species of special concern
River lamprey	State species of special concern
Pacific lamprey	Federal species of concern
Sacramento splittail	State species of special concern
Sacramento-San Joaquin roach	State species of special concern
American shad	Recreational and/or commercial importance
Striped bass	Recreational and/or commercial importance
Warmwater game fish*	Recreational and/or commercial importance
Sacramento River winter-run Chinook salmon	Federally and State endangered
White sturgeon	State species of special concern
Longfin smelt	Federal species of concern, State threatened
Delta Smelt	Federal and State threatened

Methodology

Effects on fish species of focused evaluation were assessed by evaluating hydrologic and water temperature model outputs to identify changes in aquatic habitat that could affect fish species of focused evaluation. Specific types of model output used to assess changes in fisheries habitat conditions are summarized below. Refer to Appendix D for detailed descriptions of the types of model output and their application to the fisheries impact assessment. In addition, HEC-6T modeling was completed to assess channel stability and sedimentation (see Section 4.2 and the Engineering Report of the Manual Update (USACE 2017)). The HEC-6T modeling did not take into consideration USBR's CVPIA spawning gravel augmentation program on the lower American River.

Long-term Average Flow and Average Flow by Water Year Type

Post-processing tools used monthly output for the regional effects assessment area and daily output for the lower American River to calculate the long term average flows by month that would occur over the respective simulation periods under the alternatives and the basis of comparison. Monthly average simulated flows by water year type were used to compare differences between the basis of comparison and Alternative 2. Presented in tabular format, the data tables for the long term average flows by month, and the monthly average flows by water year type, demonstrate the changes expected to occur with the Alternative 2, relative to the basis of comparison.

Flow Exceedance Distributions

Monthly flow exceedance distributions (or curves) were developed from monthly CalSim II output for the regional effects assessment area and daily HEC-ResSim output for the lower American River for the entire simulation period. These distributions illustrate the distribution of simulated flows with Alternative 2 and the basis of comparison. Exceedance distributions generally represent the monthly flow output for a given month sorted by magnitude for the entire period of record. In general, flow exceedance distributions represent the probability, as a percentage of time that modeled flow values would be met or exceeded at a specific location during a certain period. Therefore, exceedance distributions demonstrate the cumulative probabilistic distribution of flows for each month at a given river location under a given simulation. Exceedance distributions also allow a comparison of flow output among model scenarios without attributing unwarranted specificity to changes between particular model years. Exceedance distributions are particularly useful for examining flow changes occurring at lower flow levels. Results from past instream flow studies indicate that salmonid spawning and rearing habitat is most sensitive to changes during lower-flow conditions (CDFG 1994; USFWS 1985). Given the sensitivity of various lifestages to lower-flow conditions, this impact assessment specifically evaluates flow differences during low-flow conditions.

Flow-Dependent Habitat Availability

Spawning Weighted Usable Area

Flow-dependent habitat availability refers to the quantity and quality of habitat available to individual species and lifestages for a particular instream flow. The physical habitat simulation (PHABSIM) system is a commonly used method to express indices of the quantity and quality of habitat associated with specific flows. PHABSIM is the combination of hydraulic and habitat models, the output of which is expressed as weighted usable area (WUA). PHABSIM is used to predict the relationship between instream flow and the quantity and quality of habitat for various lifestages of one or more species of fish.

For the Chinook salmon and steelhead spawning lifestage, flow-dependent habitat availability refers to the amount of spawning habitat, characterized by the suitability of water depths, velocities, and substrate, for successful spawning that is, in part, contingent on stream flow. Salmonids typically deposit eggs within a range of depths and velocities that ensure adequate exchange of water between surface and substrate interstices to maintain high oxygen levels and remove metabolic wastes from the redd. Stream flow directly affects the availability of spawning habitat (SWRI 2002).

Spawning WUA-discharge relationships were applied to simulated mean monthly flows (regional effects assessment) and to simulated mean daily flows (lower American River) for anadromous salmonids. Although substantial flow changes are not expected in the regional area, because the relationships between flow and flow-dependent spawning habitat is not linear, spawning WUA-discharge relationships were applied to anadromous salmonids in the lower Feather River and the upper Sacramento River.

The resulting species-specific annual spawning WUA output was used to develop exceedance distributions, and calculate long-term average spawning WUA and average spawning WUA by water year type, which was used to evaluate changes in spawning habitat under with-project conditions, relative to the basis of comparison.

Appendix D provides a detailed discussion of the spawning WUA-discharge relationships used for winter-run, fall-run and late fall-run Chinook salmon and steelhead spawning in the upper Sacramento River and for steelhead and spring-run and fall-run Chinook salmon spawning in the lower feather River and their application. In addition, a detailed discussion of the spawning WUA-discharge relationships used for fall-run Chinook salmon and steelhead in the lower American River and their application is included in Appendix D.

Because of the lack of habitat-discharge relationships for fry and juvenile Chinook salmon and steelhead rearing in the lower American River, the lower Feather River, and the upper Sacramento River, these lifestages are not evaluated using PHABSIM habitat-discharge relationships in this assessment. Rather, the evaluation of juvenile fall-run Chinook salmon and steelhead habitat suitabilities in the lower American River in this evaluation focuses on differences in flow and differences in water temperature, which is the primary stressor to these lifestages.

Redd Dewatering

Changes in flow and resultant changes in river stage have the potential to affect the probability of anadromous salmonid redd dewatering during the embryo incubation periods. An annual redd dewatering index is calculated in Appendix D to assess the potential effects of flow fluctuations on Chinook salmon and steelhead redd dewatering in the lower American River by incorporating information on the spatial and temporal distributions of spawning activity, redd depth distribution, duration of embryo incubation through fry emergence, and maximum reduction in river stage throughout the incubation periods.

Typically, the evaluation of the potential redd dewatering effects of flow fluctuations on salmonids involves calculating flow (or river stage) reductions between consecutive days along the spawning area during the spawning and embryo incubation season, and expressing the number of stage reductions of a given magnitude that occurred during the spawning and embryo incubation period. Interpretations of results using this approach are often limited because information concerning the percentage of the spawning population potentially affected by the stage reductions occurring during the spawning and embryo incubation season were not incorporated. In general, most redds are constructed during identifiable peaks of fall-run Chinook salmon and steelhead spawning activity, with variable overall temporal and spatial distributions.

The potential for fall-run Chinook salmon and steelhead redd dewatering due to daily flow fluctuations in the lower American River under Alternative 2 and basis of comparison is analyzed through an annual weighted redd dewatering index. The potential dewatering effects of changes in daily flows and corresponding changes in river stage and water temperatures are weighted by the expected temporal and spatial distributions of Chinook salmon and steelhead spawning activity in the lower American River. In addition to the information on the expected temporal and spatial distributions of spawning activity, the index incorporates information on the expected depth distributions of Chinook salmon and steelhead redds, the duration of embryo incubation and the maximum river stage reduction through fry emergence experienced by redds of a same cohort (i.e., redds built on the same day and within the same spawning area or reach during the Chinook salmon and steelhead spawning seasons). Details on the calculation of the annual dewatering index as well as on the various distributions used in the calculations are provided in Appendix D.

The annual weighted redd dewatering index provides annual estimates of the maximum proportions of redds, relative to the total number of redds built during the species' spawning periods, that were potentially dewatered at least once due to decreases in flow and associated drops in water elevation occurring from the date of redd construction through the corresponding date of fry emergence.

The annual redd dewatering index is generated for both fall-run Chinook salmon and steelhead in the lower American River for the entire simulation period for the Folsom WCM Project Alternatives and the basis of comparison. The resulting series of annual values for redd dewatering index for each species are used to calculate and compare the corresponding redd dewatering exceedance distributions and long-term averages and averages by water year type for the Folsom WCM alternatives and basis of comparison.

Water Temperature Exceedance Distributions

Monthly water temperature exceedance distributions (or curves) were developed from Reclamation's monthly water temperature model output (regional effects area) and from the daily water temperature modeling (lower American River) for the entire simulation period. These distributions illustrate the distribution of simulated water temperatures with Alternative 2 and the basis of comparison. In general, water temperature exceedance distributions represent the probability, as a percentage of time, that modeled water temperature values would be met or exceeded at a specific location during a certain period. Monthly water temperature exceedance distributions were applied to species and lifestage-specific water temperature index (WTI) values with Alternative 2 relative to the basis of comparison.

Water temperature evaluation guidelines have been developed more extensively for Chinook salmon and steelhead than for other fish species in the Central Valley. Species and lifestage-specific WTI values developed by Bratovich et al. (2012) were used as a means to assess the effects of Alternative 2, relative to the basis of comparison, on Chinook salmon and steelhead in the project area. Bratovich et al. (2012) evaluated water temperature suitabilities associated with the reintroduction of spring-run Chinook salmon and steelhead into the upper Yuba River Basin and described development of the upper optimum (UO) WTI values and upper tolerable (UT) WTI values used for this assessment (Table 4-21).

Table 4-21. Lifestage-specific Upper Optimum and Upper Tolerance WTI Values for Chinook Salmon and Steelhead.

Chinook Salmon			Steelhead		
Lifestage	**Upper Optimum WTI**	**Upper Tolerance WTI**	**Lifestage**	**Upper Optimum WTI**	**Upper Tolerance WTI**
Adult immigration	64°F	68°F	Adult immigration	64°F	68°F
Adult holding	61°F	65°F	Adult holding	61°F	65°F
Spawning	56°F	58°F	Spawning	54°F	57°F
Embryo incubation	56°F	58°F	Embryo incubation	54°F	57°F
Juv. rearing and outmigration	61°F	65°F	Juv. rearing and outmigration	65°F	68°F
Smolt emigration	63°F	68°F	Smolt emigration	52°F	55°F

Note:
[1]*The upper optimum temperature represents the upper boundary of the optimum range and represents a temperature below which growth, reproduction, and/or behavior are not affected by temperature.*
[2]*The upper tolerable temperature represents a water temperature at which fish can survive indefinitely, without experiencing substantial detrimental effects to physiological and biological functions such that survival occurs, but growth and reproduction success are less than at optimum water temperature.*

Chinook salmon holding WTI values were applied only to the holding of winter-run and spring-run Chinook salmon, because fall-run Chinook salmon generally enter freshwater in a sexually mature state and reportedly spawn relatively soon after reaching freshwater spawning grounds. The Chinook salmon smolt emigration WTI values were applied only to spring-run Chinook salmon, because fall-run and winter-run Chinook salmon generally emigrate from Central Valley rivers as young-of-the-year (Kimmerer and Brown 2006).

Lifestage-specific WTI values were also applied for other fish species of focused evaluation, based on reported lifestage-specific water temperature tolerances and preferences. Appendix D describes WTI values for other fish species and the rationale for the selection of representative WTI values and ranges evaluated. WTI value ranges are typically used for a lifestage when insufficient information is available to identify specific WTI values.

The WTI values applied to simulated water temperatures in this assessment represent water temperature values above which the water temperature could be considered to be impactive, for evaluation purposes.

The WTI values are not meant to be significance thresholds but instead provide a mechanism by which to compare the resultant water temperatures associated with Alternative 2 relative to the basis of comparison.

Chinook Salmon Early Lifestage Mortality

The water temperature results for the lower American River were also used as inputs to the updated lower American River Mortality Model (LAR Mortality Model) (Water Forum and USACE 2015) to estimate thermally induced annual mortality rates for the embryonic lifestage of fall-run Chinook salmon in the lower American River. The LAR Mortality Model was initially developed by Reclamation in 1983 for the Sacramento River and was later applied to the lower American River in the 1990s. Because additional information has become available since the LAR Mortality Model was originally developed that could be incorporated into the model to improve its accuracy, the Water Forum and USACE (2015) updated the LAR Mortality Model during 2013 through 2015. The following LAR Mortality Model assumptions were refined based on new data and information that has become available:

- The temporal distribution for the arrival of spawning fall-run Chinook salmon adults in the lower American River
- The temporal distribution for fall-run Chinook salmon spawning in the lower American River
- The spatial distribution of spawning fall-run Chinook salmon in the lower American River
- The thermally induced Chinook salmon daily mortality rates for pre-spawn eggs, fertilized eggs, and pre-emergent fry
- The Accumulated Thermal Unit (ATU) thresholds associated with the end of the fertilized-egg and pre-emergent fry lifestages

Simulated annual total early lifestage mortality of fall-run Chinook salmon in the lower American River were generated for the entire simulation period for Alternative 2 and the basis of comparison. The resulting series of annual values for early lifestage mortality were used to calculate and compare the corresponding early lifestage mortality exceedance distributions and long-term averages and averages by water year type for the Folsom WCM alternatives and the basis of comparison.

Sacramento-San Joaquin Delta Species-Specific Analytical Approach

The Manual Update could influence aquatic habitat conditions by altering Delta inflow and water export operations. Therefore, aquatic habitat conditions and export operations (e.g., fish salvage operations) were evaluated to identify effects on Delta species of focused evaluation.

Although many fish species inhabit the Delta for all or part of their lifecycles, the following species of focused evaluation in Table 4-22 are considered for detailed evaluation in the Delta because they are Federally or state listed as threatened or endangered, are proposed for Federal or state listing as threatened or endangered, are species classified as candidates for future Federal or state listing, are state species of special concern, or are considered commercially or recreationally important. Table 4-22 also summarizes the parameters assessed to determine effects on the pertinent life stages for each species.

Table 4-22. Fish Species of Focused Evaluation in the Sacramento–San Joaquin Delta.

Common Name	Parameters Assessed to Determine Effects on Species Life Stages
• Sacramento River winter-run Chinook salmon ESU	Delta outflows; Old and Middle Rivers (OMR) flows; seasonal attraction flows
• Central Valley spring-run Chinook salmon ESU	Delta outflows; seasonal attraction flows; OMR flows
• Central Valley fall-/late fall-run Chinook salmon ESU	Delta outflows; seasonal attraction flows; OMR flows
• Central Valley steelhead DPS	Delta emigration and rearing habitat; seasonal attraction flow
• Delta smelt	Water temperature, OMR flows; Delta outflows; X2 location;
• Longfin smelt	Water temperature, OMR flows; X2 location;
• American shad	X2 location
• Striped bass	X2 location

The habitat requirements and distribution for the above species are largely representative of the habitat requirements and distribution of other Delta fish species. Therefore, the analysis of effects on the above species are assumed to cover the range of effects on other Delta fishery resources.

<u>Spawning Gravel Mobilization</u>

Several studies have evaluated spawning gravel variables within the greater Sacramento River watershed associated with grain size, flow rate, bed mobilization, bed coarsening, spawning use, etc. (Hannon et al, 2007; Stillwater Sciences, 2007; Ayers Associates, 2001; Parfitt and Buer, 1981). Additional channel stability and sedimentation modeling was completed by USACE (2017), NHC (2015), and Tetratech (2016) to evaluate flow changes relative to erosion and bed mobilization. In general, fine grains and sands may mobilize at low flows (<7,000 cfs) and full bed mobilization can start to occur in the mid-30,000 cfs range dependent on channel geometry. However, 50,000 cfs is considered a flow rate where full bed mobilization is most likely to initiate independent of channel geometry. Flows in excess of 80,000 cfs, or to frequent of flows at full bed mobilization rates, can lead to bed coarsening. In order to estimate changes in frequency of spawning gravel mobilization, daily flows for the entire 82-year period of record were developed and modeled. For the comparison, the number of daily occurrences of flows exceeding 30,000 cfs at 10,000 cfs intervals, and then a peak bed mobilization range of 40,000 to 80,000 cfs, were compared between scenarios to identify potential changes in spawning gravel mobilization.

Basis of Significance

The following thresholds are used to determine whether the alternatives would have a significant effect on fisheries resources or on threatened or endangered aquatic species. There would be a significant impact on fisheries resources if the alternatives would:

- Interfere substantially with the movement of native resident or migratory fish, substantially reduce the habitat of a fish species, or cause a fish population to drop below self-sustaining levels;
- Result in substantial habitat degradation for fisheries or aquatic species identified by CDFW, NMFS, or USFWS as a candidate, sensitive, or special-status species; or
- Significantly increase the occurrence of daily flows over the period of record (≥5 percent) that could lead to bed coarsening

No Action/No Project

Under the No Action Alternative, Folsom Lake and Dam would continue to operate under the existing SAFCA/Reclamation interim agreement. The new auxiliary dam would not be utilized except in extremely rare circumstances that threaten the structural integrity of Folsom Dam. Average peak flows, release rates and surface water levels would be expected to remain the same.

Current operations of the Folsom Dam does not retain enough cold water to facilitate both cold water releases during the warmest months (i.e., July through September) to provide maximum thermal benefits to over-summer juvenile steelhead rearing in the lower American River, and cold water releases during October and November that would maximally benefit fall-run Chinook salmon immigration, spawning, and incubation.

American River flows would continue to be influenced by numerous requirements and regulations, including the current Fall X2 Delta outflow, water quality temperature criteria, Folsom Dam flood storage requirements and Delta exports, all of which would be expected to remain unchanged. Under the No Action/No Project Alternative, high water demand in the local and regional effects assessment area will continue to limit the amount of cold water available to the American River and suitable habitat for salmonids and other sensitive species downstream.

Without the use of the auxiliary dam and increased variable storage space, flows to the Delta will continue to be low during dry years.

Alternative 2 – Forecast Informed Operations with Variable Folsom Flood Control Space (400,000 af to 600,000 af)

Lower American River

Flows

For salmonid and other fish species, daily flow and water temperature model results were examined for the lower American River below Nimbus Dam, at Watt Avenue, and near the mouth of the lower American River (i.e., RM 1). In addition to flow and water temperature modeling, model results for spawning habitat availability (WUA) and an index for redd dewatering were examined for steelhead and fall-run Chinook salmon. For fall-run Chinook salmon, an updated lower American River early lifestage mortality model also was used to compare thermally-influenced early lifestage mortality.

Monthly water temperature exceedance distributions demonstrate that water temperatures are generally similar most of the time during all months, but are slightly higher over portions of the distributions during March and April (while water temperatures under both scenarios are below 56°F). Temperatures were slightly lower over portions of the monthly distributions during May, June, August, September, and October. In July temperatures were higher with similar frequencies.

A summary of general changes in flows in the lower American River below Nimbus Dam under Alternative 2 - Forecast-informed Operations relative to No Action/No Project is provided below, and is based on changes in long-term average monthly flow and average monthly flow by water year type, and monthly cumulative probability of exceedance distributions over the entire simulation period.

Generally, flows are higher more often during March through June, September, October, and December. Flows are lower more often under Alternative 2 during January, February, July, August, and November, as described in more detail for below Nimbus Dam, at Watt Avenue, and near the mouth.

Long-term average monthly flows below Nimbus Dam under Alternative 2 - Forecast-informed Operations relative to No Action/No Project are generally slightly lower during November through February and August, and slightly higher during March through June, September, and October (Table 4-23). Average monthly flows exhibit similar trends during wet and above-normal water years. Average monthly flows during below-normal water years are generally slightly lower during February and March, and are slightly higher during April through June and September. During dry water years, average monthly flows are slightly lower during February, April, and August and substantially lower during March, and are generally slightly higher during May through July and September through November. During critical water years, average monthly flows are generally slightly higher during November through January, March, July, and August, and are lower during February and April. Long-term average monthly flows and average monthly flow by water year type at Watt Avenue and at the mouth of the lower American River exhibit trends similar to those described for below Nimbus Dam.

Monthly flow exceedance distributions for Alternative 2 - Forecast-informed Operations and No Action/No Project demonstrate that flows are generally similar most of the time during most months, but are lower substantially more often during February, and are higher substantially more often during March and April under Alternative 2 - Forecast-informed Operations (Figures 4-16 to 4-27). In addition, flows generally decrease during a portion of the lowest flow conditions (i.e., lowest 25 percent of the monthly distribution) during April. By contrast, flows increase during the lowest flow conditions during July.

Table 4-23. Average Monthly Flows below Nimbus Dam under Alternative 2 - Forecast-informed Operations and No Action/No Project.

Analysis Period	Flow (cfs)											
	Oct	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period												
No Action/No Project	2,119	3,162	3,597	4,867	5,394	3,963	3,273	3,609	3,555	3,451	2,462	2,552
Alternative 2-Forecast-informed operations	2,154	3,106	3,497	4,610	4,976	4,242	3,524	3,680	3,698	3,471	2,380	2,611
Difference	35	-56	-100	-257	-418	279	251	71	143	20	-82	59
Percent Difference[3]	1.7	-1.8	-2.8	-5.3	-7.7	7.0	7.7	2.0	4.0	0.6	-3.3	2.3
Water Year Types												
Wet												
No Action/No Project	2,299	4,008	6,097	9,088	9,212	6,264	5,114	6,134	6,048	3,558	3,439	3,815
Alternative 2-Forecast-informed operations	2,335	3,864	5,892	8,509	8,328	7,200	5,737	6,153	6,211	3,529	3,233	3,875
Difference	36	-144	-205	-579	-884	936	623	19	163	-29	-206	60
Percent Difference[3]	1.6	-3.6	-3.4	-6.4	-9.6	14.9	12.2	0.3	2.7	-0.8	-6.0	1.6
Above Normal												
No Action/No Project	2,085	3,885	3,561	6,254	7,224	5,457	3,280	3,368	2,728	4,169	2,252	3,728
Alternative 2-Forecast-informed operations	2,094	3,734	3,252	5,752	6,955	5,991	3,730	3,556	2,987	3,978	2,162	3,890
Difference	9	-151	-309	-502	-269	534	450	188	259	-191	-90	162
Percent Difference[3]	0.4	-3.9	-8.7	-8.0	-3.7	9.8	13.7	5.6	9.5	-4.6	-4.0	4.3
Below Normal												
No Action/No Project	2,013	2,588	2,402	2,376	4,315	2,753	3,105	3,079	2,641	4,352	1,978	1,776
Alternative 2-Forecast-informed operations	2,028	2,573	2,423	2,388	3,933	2,687	3,203	3,152	2,811	4,393	1,965	1,834
Difference	15	-15	21	12	-382	-66	98	73	170	41	-13	58
Percent Difference[3]	0.7	-0.6	0.9	0.5	-8.9	-2.4	3.2	2.4	6.4	0.9	-0.7	3.3
Dry												
No Action/No Project	2,174	2,584	1,956	1,774	1,860	2,299	1,867	1,690	2,124	3,161	2,088	1,511
Alternative 2-Forecast-informed operations	2,256	2,633	1,958	1,764	1,815	1,805	1,763	1,818	2,241	3,331	2,059	1,544
Difference	82	49	2	-10	-45	-494	-104	128	117	170	-29	33
Percent Difference[3]	3.8	1.9	0.1	-0.6	-2.4	-21.5	-5.6	7.6	5.5	5.4	-1.4	2.2
Critical												
No Action/No Project	1,751	2,066	1,557	1,251	1,257	1,106	1,130	1,270	1,546	1,826	1,438	1,014
Alternative 2-Forecast-informed operations	1,758	2,100	1,587	1,281	1,226	1,194	1,039	1,271	1,538	1,895	1,497	1,018
Difference	7	34	30	30	-31	88	-91	1	-8	69	59	4
Percent Difference[3]	0.4	1.6	1.9	2.4	-2.5	8.0	-8.1	0.1	-0.5	3.8	4.1	0.4

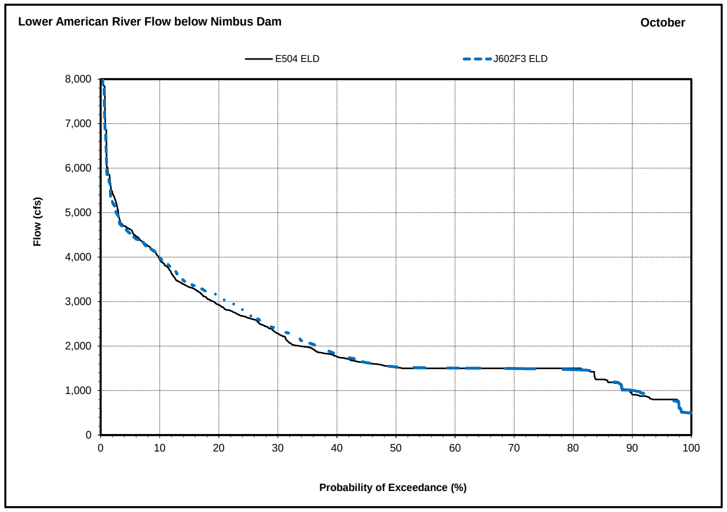


Figure 4-16. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for October under Alternative 2 - Forecast-informed Operations and No Action/No Project Condition.

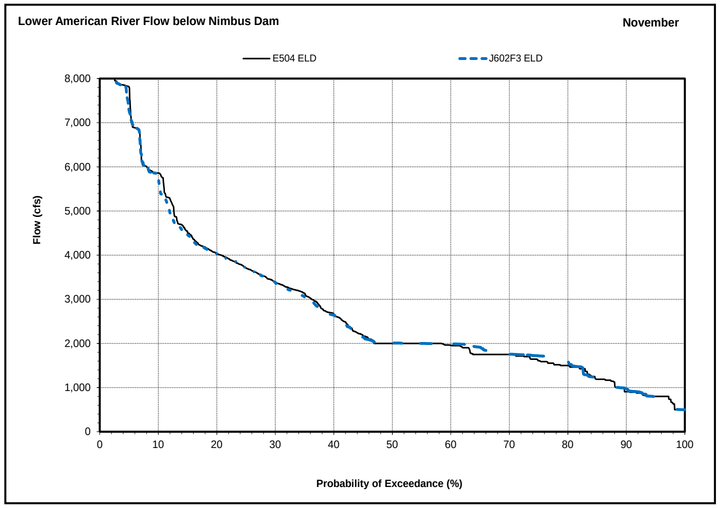


Figure 4-17. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for November under Alternative 2 - Forecast-informed Operations and No Action/No Project Condition.

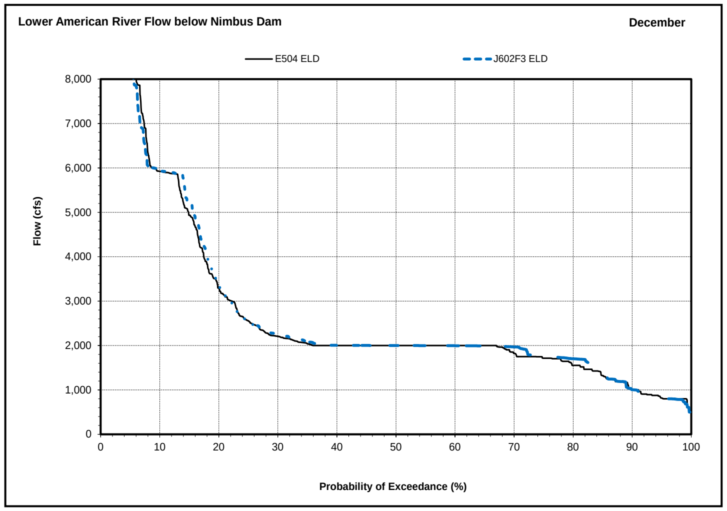


Figure 4-18. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for December under Alternative 2 - Forecast-informed Operations and No Action/No Project Condition.

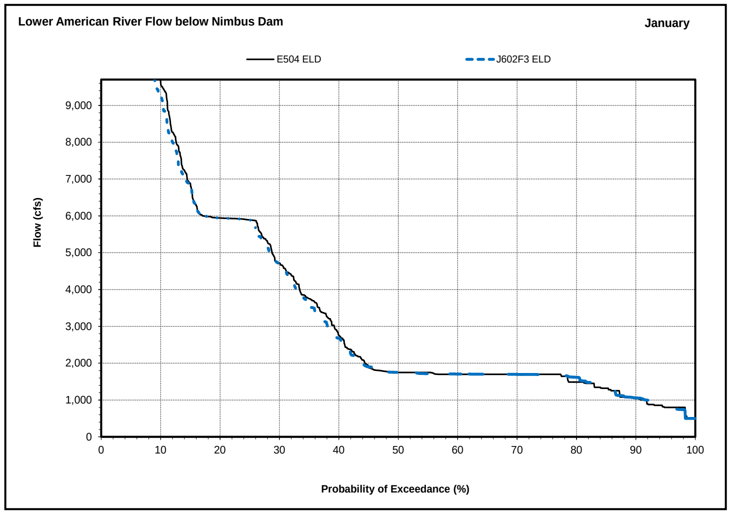


Figure 4-19. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for January under Alternative 2 - Forecast-informed Operations and No Action/No Project Condition.

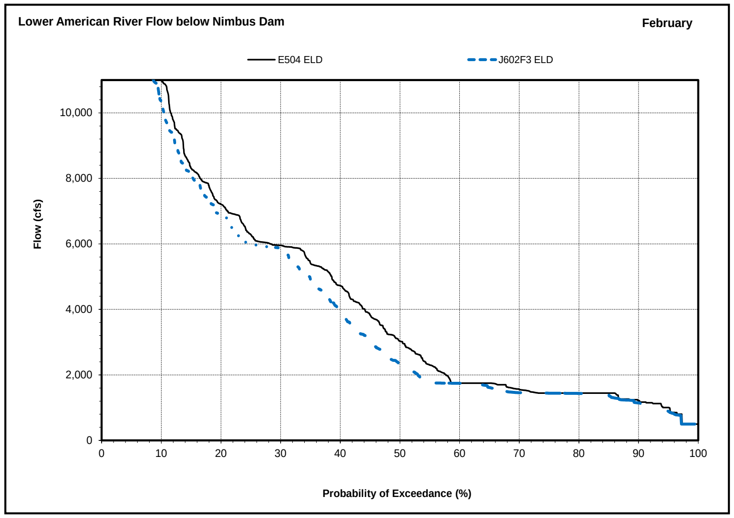


Figure 4-20. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for February under Alternative 2 - Forecast-informed Operations and No Action/No Project Condition.

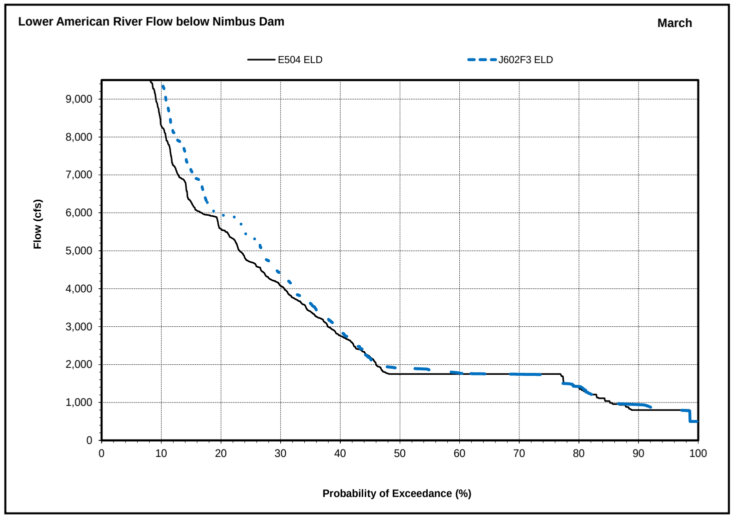


Figure 4-21. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for March under Alternative 2 - Forecast-informed Operations and No Action/No Project Condition.

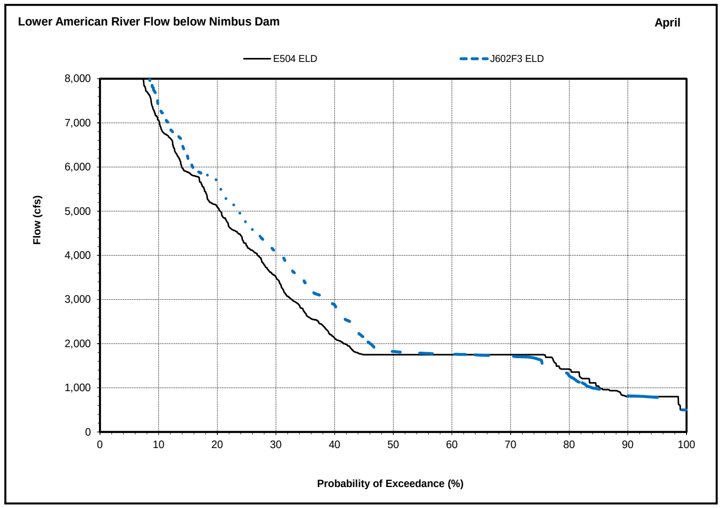


Figure 4-22. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for April under Alternative 2 - Forecast-informed Operations and No Action/No Project Condition.

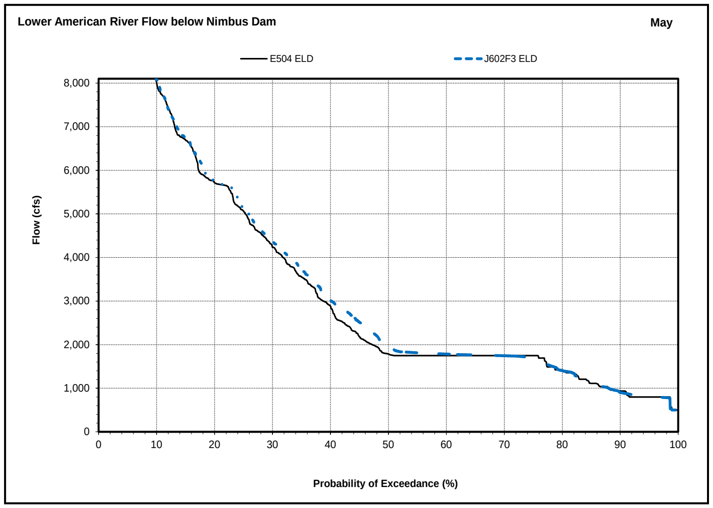


Figure 4-23. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for May under Alternative 2 - Forecast-informed Operations and No Action/No Project Condition.

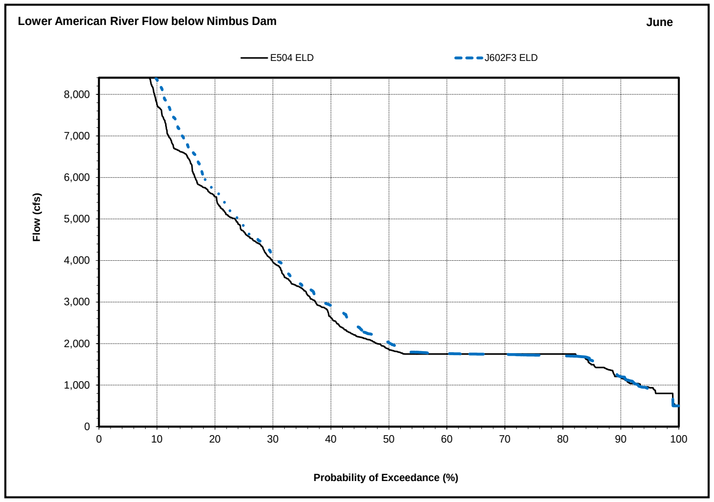


Figure 4-24. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for June under Alternative 2 - Forecast-informed Operations and No Action/No Project Condition.

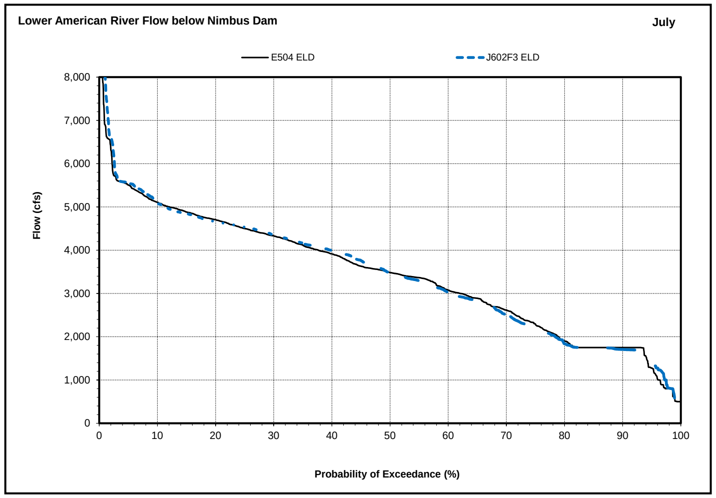


Figure 4-25. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for July under Alternative 2 - Forecast-informed Operations and No Action/No Project Condition.

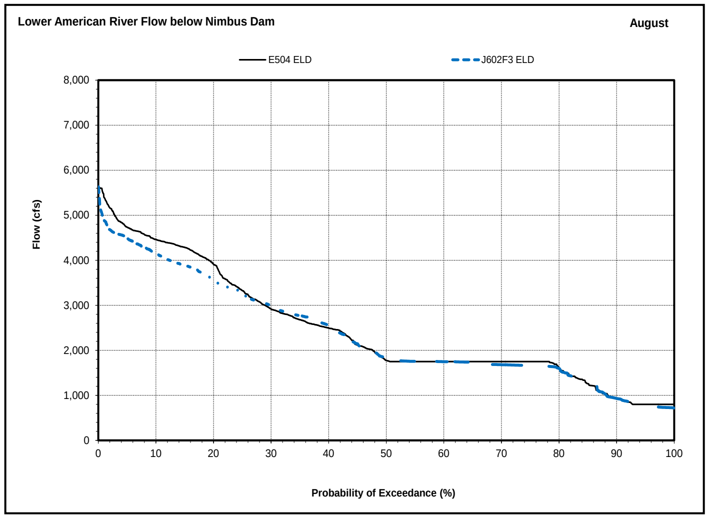


Figure 4-26. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for August under Alternative 2 - Forecast-informed Operations and No Action/No Project Condition.

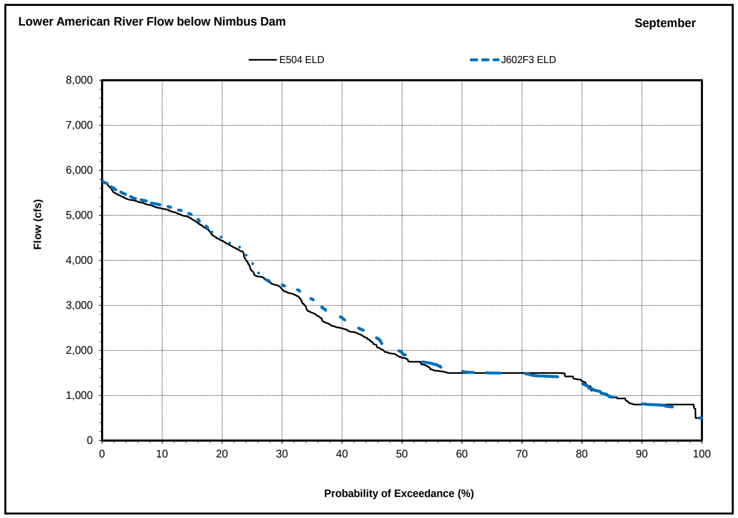


Figure 4-27. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for September under Alternative 2 - Forecast-informed Operations and No Action/No Project Condition.

Monthly flow exceedance distributions at Watt Avenue and at the mouth of the lower American River exhibit similar trends as described for below Nimbus Dam.

In addition to evaluating general changes in the monthly flow exceedance distributions, net changes in flow of 10 percent or more are calculated based on the monthly exceedance distributions to determine whether flow increases by 10 percent or more with higher frequency, or whether flow decreases by 10 percent or more with higher frequency (i.e., the percentage of the time that flow increases by 10 percent or more minus the percentage of time that flow decreases by 10 percent or more). The net change in flow of 10 percent or more is evaluated on a monthly basis for below Nimbus Dam, at Watt Avenue and at the mouth of the lower American River for the entire distribution of flows, and/or for the lowest 40 percent of the distribution of flows, depending on the species and lifestage being evaluated.

Net changes in flow at all three locations of 10 percent or more over the entire monthly distributions are similar to the no action alternative (i.e., less than 5 percent change) during July through December (Table 4-24). Flows decrease by 10 percent or more with substantially higher frequency (i.e., 10 percent or more) during January and August, and with substantially higher frequency (i.e., 10 percent or more) during February under Alternative 2 - Forecast-informed Operations relative to No Action/No Project. By contrast, flows increase by 10 percent or more with higher frequency during May through July, and with substantially higher frequency during March and April.

Table 4-24. Monthly Net Changes in Flow of 10 percent or More below Nimbus Dam, at Watt Avenue and at the Mouth of the Lower American River.

Indicator of Potential Impact	Location	Metric	Range	Net Change in Probability of Exceedance under Alternative 2 - Forecast-informed Operations relative to the No Action/No Project Condition											
	Description	percent		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean Daily Flow (cfs)	American River below Nimbus Dam	10	All Years	2	0	0	-7	-34	21	22	8	7	5	0	4
	American River at Watt Ave	10	All Years	2	-1	-1	-7	-32	21	23	8	5	5	-4	2
	Mouth of American River (RM 1)	10	All Years	2	-1	-1	-5	-29	19	24	9	4	5	-5	1

Net changes in flow of 10 percent or more during low flow conditions are generally similar (i.e., less than 5 percent) during May, June, and August through January (Table 4-25). Net reductions in flow of 10 percent or more occur substantially more often during February and April, while a net increase in flow of 10 percent or more occurs substantially more often during July under Alternative 2 - Forecast-informed Operations relative to No Action/No Project.

Table 4-25. Monthly Net Changes in Flow of 10 percent or More during Low Flow Conditions below Nimbus Dam, at Watt Avenue and at the Mouth of the Lower American River.

Indicator of Potential Impact	Location	Metric	Range	Net Change in Probability of Exceedance under Alternative 2 - Forecast-informed Operations relative to No Action/No Project											
	Description	percent		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean Daily Flow (cfs)	American River below Nimbus Dam	10	Lower 40 percent	2	5	6	-1	-13	7	-16	0	-1	10	0	-2
	American River at Watt Avenue	10	Lower 40 percent	3	2	5	0	-11	6	-16	0	-1	10	0	-2
	Mouth of the American River (RM 1)	10	Lower 40 percent	3	2	3	-1	-9	9	-13	0	0	9	0	-1

Based on the general changes in flows and water temperatures, as well as fish species and lifestage-specific flow and water temperature-related indicators of potential impact presented below, potential changes in species and lifestage-specific suitabilities under Alternative 2 - Forecast-informed Operations relative to No Action/No Project are described in the following sections.

Alternative 2 - Forecast-informed Operations relative to No Action/No Project would result in negligible to no effect on river flow or reservoir storage and thus would not interfere with movement or habitat of migratory fish.

Water Temperature

Simulated monthly water temperatures at representative locations in the lower American River indicate that water temperatures under Alternative 2 relative to No Action/No Project would generally be similar but with some measurable increases and decreases during the spring and summer , as shown in Table 4-26 to 4-28.

Additional discussion of water temperature changes in the lower American River is provided below.

American River below Nimbus Dam. Long-term average monthly water temperatures in the American River below Nimbus Dam would be essentially equivalent during all months of the year. Monthly water temperatures by water year type would be generally equivalent or similar during most months of all water year types, but would be measurably cooler during May of dry water years and measurably warmer during April of critical water years. Monthly water temperature exceedance probability distributions would be generally cooler more often during October, November, May, and July; generally similar during December, April, August, and September; similar or warmer during January through March; and warmer more often during June.

Over the entire monthly distributions, a net measurable decrease in water temperature would occur during May. Over the warmest 25 percent of the monthly distributions, net measurable decreases in water temperature would occur over 10 percent or more in the distributions during October and May through July, and a net measurable increase would occur over 10 percent or more in the distribution during March.

Table 4-26. Comparison of Water Temperatures in the Lower American River between Alternative 2-Forecast-Informed Operations and No Action/No Project.

Evaluation Parameters	Evaluation Metrics and Summary of Effects	Results					
Water Temperature – Long-term Average and Average by Water Year Type							
River and Location	generally similar most of the time, but with measurable reductions in water temperature during late spring, summer, and early fall months throughout the river, with measurable increases in water temperature during March and August in the American River.	**Long-term and Water Year Type Average Water Temperature**					
		Long-term	**Wet**	**Above Normal**	**Below Normal**	**Dry**	**Critical**
American River below Nimbus Dam		✓	✓	✓	Cooler in May	Cooler in May & Jun	✓
American River at Watt Avenue		Cooler in May	✓	Cooler in May & Jun	Cooler in May	Cooler in May & Jun	Cooler in Jul
American River at the mouth		✓	Cooler in Mar	Cooler in May & Jun	✓	Cooler in May & Jun; warmer in Mar	Cooler in Jul

Note: "✓" refers to similar values of the evaluation metric for both scenarios.

Table 4-27. Water Temperature – Net Measurable Differences over Entire Monthly Exceedance Distributions.

River and Location	Evaluation Metrics and Summary of Effects	Entire Monthly Exceedance Distributions
American River below Nimbus Dam	Generally similar water temperatures over most of the monthly exceedance distributions, but with cooler temperatures during some months in the spring and summer below Nimbus Dam and warmer temperatures during the spring near the mouth of the American River.	Net measurable decreases in May & Jun
American River at Watt Avenue		Net measurable decrease in May & Jun
American River at the mouth		Net measurable decreases in May & Jun; net increase in Aug

Table 4-28. Water Temperature – Net Measurable Differences over Warmest 25 percent of Monthly Exceedance Distributions.

River and Location	Evaluation Metrics and Summary of Effects	Warmest 25 percent of the Monthly Exceedance Distributions
American River below Nimbus Dam	Generally similar water temperatures over most of the monthly exceedance distributions, but with some differences during the summer in the Sacramento and Feather Rivers and differences during the spring and summer in the American River.	Net measurable decreases in Apr–Jul & Oct; net increase in Mar
American River at Watt Avenue		Net measurable decreases in May, Jun, & Jul
American River at the mouth		Net measurable decreases in May–Jul

American River at Watt Avenue. Long-term average monthly water temperatures in the American River at Watt Avenue would be essentially equivalent during all months of the year. Monthly water temperatures by water year type would be generally equivalent or similar during most months of most water year types, but would be warmer in March of above-normal water years, warmer during March and April of dry water years, and cooler in July but warmer during April and May of critical water years. Monthly water temperature exceedance probability distributions would be generally similar during December, May, July, and September; similar or warmer during January, February, April, June, and August; warmer during March; and similar or cooler during October and November.

Over the entire monthly distributions, a net measurable increase in water temperature would occur over 10 percent or more of the time during June. Over the warmest 25 percent of the monthly distributions, a net measurable decrease in water temperature would occur over 10 percent or more in the distribution during July, and net measurable increases would occur over 10 percent or more in the distributions during March, April, and June.

American River at the Mouth. Long-term average monthly water temperatures in the American River at the mouth (i.e., RM 1) would be essentially equivalent during all months of the year. Monthly water temperatures by water year type would be generally equivalent or similar most of the time during all water year types, but would be measurably warmer during March and June of above-normal water years, measurably warmer during March and April of dry water years, and measurably cooler during July and measurably warmer during April and May of critical water years. Monthly water temperature exceedance probability distributions would be generally similar during December, July, and September; similar or cooler during October and November; similar or warmer during January, February, April, May, and August; and warmer during March and June.

Over the entire monthly distributions, net measurable increases in water temperature would occur over 10 percent or more of the time during March, June, and August. Over the warmest 25 percent of the monthly distributions, a net measurable decrease in water temperature would occur over 10 percent or more in the distribution during July, and net measurable increases would occur over 10 percent or more in the distributions during March through June and August.

Steelhead

Changes in life stage-specific temperature conditions are presented in Table 4-29. Differences in spawning WUA are shown in Table 4-30 and Figure 4-28. Comparisons in Redd dewatering rates are shown in Table 4-31 and Figure 4-29. Results of the modeling output comparisons are discussed in further detail in Appendix D.

Overall, in consideration of all flow and water temperature-related indicators of potential impact, as well as peak lifestage-specific temporal considerations, and limiting factors and key stressors for steelhead in the lower American River, habitat conditions are expected to be slightly more suitable for steelhead under Alternative 2 - Forecast-informed Operations relative to No Action/No Project. Although conditions may be slightly less suitable for smolt emigration, the probability of redd dewatering is reduced, spawning habitat availability increases slightly, and water temperatures are reduced more often during some spring and summer months. Therefore, key stressors to steelhead in the lower American River identified by NMFS (2014), including flow fluctuations and elevated water temperatures, may be less impactful to steelhead under Alternative 2 - Forecast-informed Operations relative to No Action/No Project.

With less use of the variable space flood storage and greater capacity to capture spring-refill, Alternative 2-Forecast-informed operations provides Reclamation more flexibility in managing conservation storage to meet steelhead lifestage requirements than does the No Action/No Project operations. While model results show beneficial and adverse effects to meeting steelhead lifestage requirements, Alternative 2 provides greater potential for stored water to be managed by Reclamation to meet these requirements than does the No Action/No Project condition. Additionally, SAFCA will establish or contribute to a monitoring program to evaluate movement of spawning gravel in the upper reaches of the lower American River. SAFCA will also supplement the existing lower American River gravel augmentation to compensate for the approximate loss of 300 short tons/year of spawning gravel that could potentially be lost from increases in mid-range flows (30,000-80,000 cfs). Therefore, affects to steelhead in the lower American River would be considered less than significant.

Table 4-29. Net Difference in Water Temperature Index Value Exceedance Probabilities for Steelhead.

Steelhead in the Lower American River																	
Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric	Range	Net Change in Probability of Exceedance under Alternative 2 - Forecast-informed Operations relative to the No Action/No Project Condition											
			Description	Value (°F)		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Immigration	November through March	Mean Daily Water Temp (°F)	American River at Watt Avenue	64	All Years		0	0	0	0	0						
				68	All Years		0	0	0	0	0						
			Mouth of the American River (RM 1)	64	All Years		0	0	0	0	0						
				68	All Years		0	0	0	0	0						
Adult Holding	November through March	Mean Daily Water Temp (°F)	American River below Nimbus Dam	61	All Years		0	0	0	0	0						
				65	All Years		0	0	0	0	0						
			American River at Watt Avenue	61	All Years		0	0	0	0	0						
				65	All Years		0	0	0	0	0						
Adult Spawning	January through mid-April	Mean Daily Water Temp (°F)	American River below Nimbus Dam	54	All Years				0	0	1	8					
				57	All Years				0	0	0	0					
			American River at Watt Avenue	54	All Years				0	0	1	8					
				57	All Years				0	0	0	0					
Embryo Incubation	January through May	Mean Daily Water Temp (°F)	American River below Nimbus Dam	54	All Years				0	0	1	3	-1				
				57	All Years				0	0	0	-3	-3				
			American River at Watt Avenue	54	All Years				0	0	1	-1	0				
				57	All Years				0	0	0	1	-3				
Juvenile Rearing and Downstream Movement	Year-round	Mean Daily Water Temp (°F)	American River below Nimbus Dam	65	All Years	-2	0	0	0	0	0	0	0	-5	-2	-2	-3
				68	All Years	0	0	0	0	0	0	0	0	0	-2	0	0
			American River at Watt Avenue	65	All Years	-1	0	0	0	0	0	0	-3	-1	1	-1	0
				68	All Years	-1	0	0	0	0	0	0	-1	-4	0	-1	-1
			Mouth of the American River (RM 1)	65	All Years	-1	0	0	0	0	0	1	-2	-2	-1	3	0
				68	All Years	0	0	0	0	0	0	0	-3	-2	2	-2	-2
Smolt Emigration	December through April	Mean Daily Water Temp (°F)	American River at Watt Avenue	52	All Years			0	0	0	0	2					
				55	All Years			0	0	0	1	-1					
			Mouth of the American River (RM 1)	52	All Years			0	0	1	0	1					
				55	All Years			0	0	0	0	-1					

Table 4-30. Long-term Average and Average by Water Year Type Steelhead Spawning WUA under Alternative 2 - Forecast-informed Operations and No Action/No Project Conditions.

Lower American River Steelhead Annual Spawning WUA Averages (percent of Maximum WUA)			
Water Year Type Category	**Alternative 2 - Forecast-informed Operations**	**No Action/No Project**	**Difference**
All Water Years	72.4 percent	71.6 percent	0.8 percent
Wet	53.3 percent	51.7 percent	1.6 percent
Above Normal	65.9 percent	64.4 percent	1.5 percent
Below Normal	82.5 percent	81.8 percent	0.7 percent
Dry	89.6 percent	89.4 percent	0.2 percent
Critical	82.0 percent	82.5 percent	–0.5 percent

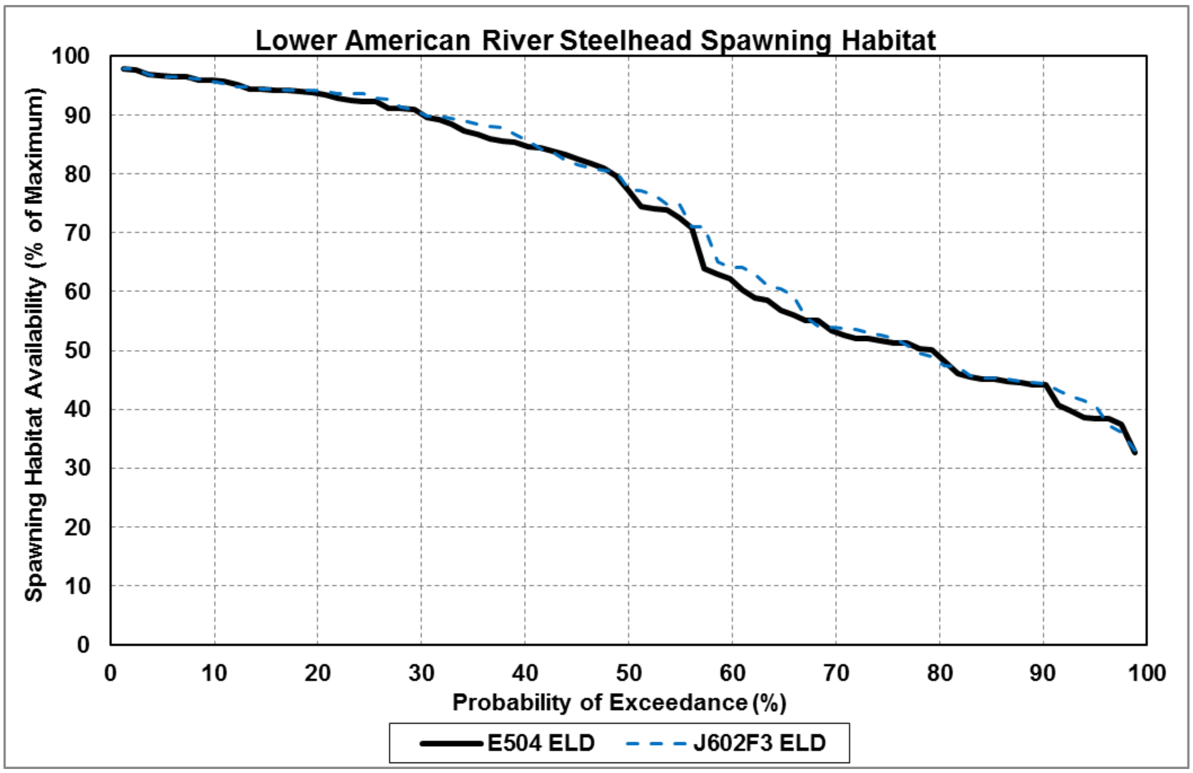


Figure 4-28. Steelhead Spawning WUA Exceedance Distribution Under Alternative 2 - Forecast-informed Operations and No Action/No Project Conditions.

Table 4-31. Long-term Average and Average by Water Year Type Steelhead Redd Dewatering Index Under Alternative 2 - Forecast-informed Operations and No Action/No Project Conditions.

Lower American River Steelhead Annual Redd Dewatering Index Averages (percent)			
Water Year Type Category	**Alternative 2 - Forecast-informed Operations**	**No Action/No Project**	**Difference**
All Water Years	25.2 percent	27.3 percent	–2.1 percent
Wet	45.2 percent	49.2 percent	–4.0 percent
Above Normal	43.6 percent	45.6 percent	–2.0 percent
Below Normal	15.1 percent	17.5 percent	–2.4 percent
Dry	4.8 percent	5.1 percent	–0.3 percent
Critical	2.6 percent	2.5 percent	0.1 percent

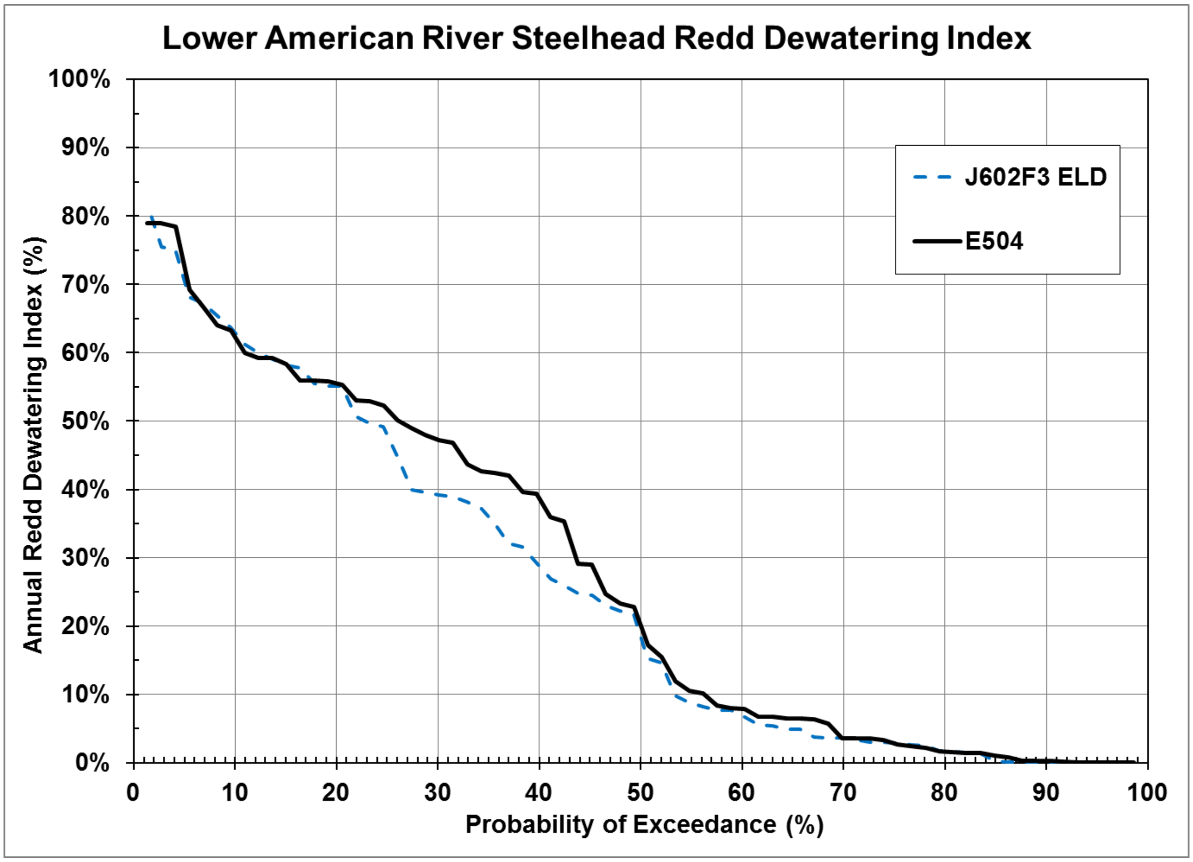


Figure 4-29. Steelhead Redd Dewatering Index Exceedance Distribution Under Alternative 2 - Forecast-informed Operations and No Action/No Project Conditions.

Fall-run Chinook Salmon

Differences in spawning WUA are shown in Table 4-32 and Figure 4-30. Changes in life stage-specific temperature conditions are presented in Tables 4-33. Comparisons in Redd dewatering rates are shown in Table 4-34 and Figure 4-31. Comparisons in early lifestage mortality rates are shown in Table 4-35 and Figure 4-32. Results of the modeling output comparisons are discussed in further detail in Appendix D.

Table 4-32. Long-term Average and Average by Water Year Type Fall-run Chinook Salmon Spawning WUA under Alternative 2 - Forecast-informed Operations and No Action/No Project Conditions.

Lower American River Fall-run Chinook Salmon Annual Weighted WUA Averages (percent)			
Water Year Type Category	**Alternative 2 - Forecast-informed Operations**	**No Action/No Project**	**Difference**
All Water Years	84.4 percent	84.2 percent	0.2 percent
Wet	81.3 percent	80.7 percent	0.6 percent
Above Normal	81.1 percent	80.8 percent	0.3 percent
Below Normal	88.1 percent	88.5 percent	- 0.4 percent
Dry	85.3 percent	85.1 percent	0.2 percent
Critical	88.3 percent	88.4 percent	- 0.1 percent

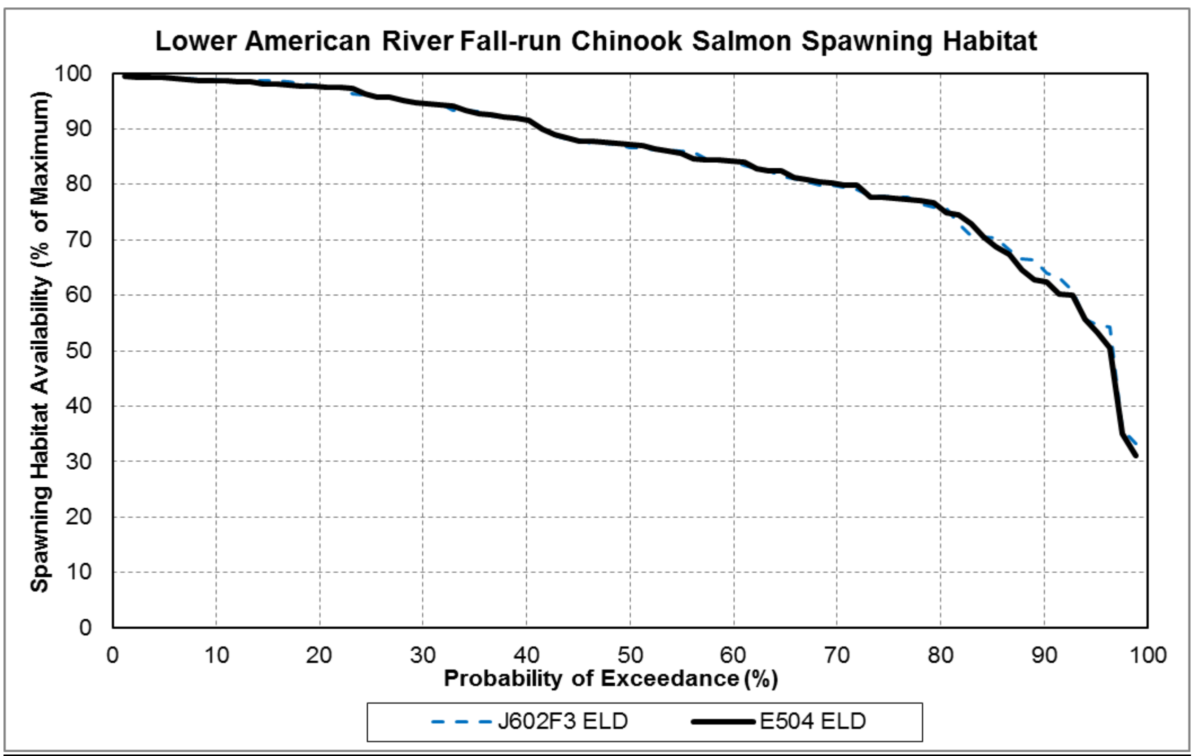


Figure 4-30. Fall-run Chinook Salmon Spawning WUA Exceedance Distribution under Alternative 2 - Forecast-informed Operations and No Action/No Project Conditions.

Table 4-33. Net Difference in Water Temperature Index Value Exceedance Probabilities for Fall-run Chinook Salmon under Alternative 2 - Forecast-informed Operations and No Action/No Project Conditions.

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under Alternative 2 - Forecast-informed Operations relative to No Action/No Project											
			Description	Value (°F)	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Immigration and Staging	August through December	Mean Daily Water Temperature (°F)	American River below Nimbus Dam	64		All Years	-3	0	0								-2	0
				68		All Years	0	0	0								0	0
			American River at Watt Avenue	64		All Years	-3	0	0								1	0
				68		All Years	-1	0	0								-1	-1
			Mouth of the American River (RM 1)	64		All Years	-2	0	0								2	0
				68		All Years	0	0	0								-2	-2
Adult Spawning	Mid-October through December	Mean Daily Water Temperature (°F)	American River below Nimbus Dam	56		All Years	0	0	0									
				58		All Years	0	1	0									
			American River at Watt Avenue	56		All Years	0	1	0									
				58		All Years	0	1	0									
Embryo Incubation	Mid-October through March	Mean Daily Water Temperature (°F)	American River below Nimbus Dam	56		All Years	0	0	0	0	0	0						
				58		All Years	0	1	0	0	0	0						
			American River at Watt Avenue	56		All Years	0	1	0	0	0	1						
				58		All Years	0	1	0	0	0	0						
Juvenile Rearing and Emigration	January through May	Mean Daily Water Temperature (°F)	American River below Nimbus Dam	61		All Years				0	0	0	0	-5				
				65		All Years				0	0	0	0	0				
			American River at Watt Avenue	61		All Years				0	0	0	0	-3				
				65		All Years				0	0	0	0	-3				
			Mouth of the American River (RM 1)	61		All Years				0	0	0	1	-3				
				65		All Years				0	0	0	1	-2				

Table 4-34. Long-term Average and Average by Water Year Type Fall-run Chinook Salmon Redd Dewatering Index.

Lower American River Chinook Salmon Annual Redd Dewatering Index Averages (percent)			
Water Year Type Category	**Alternative 2 - Forecast-informed Operations**	**No Action/No Project**	**Difference**
All Water Years	10.0 percent	10.1 percent	0.0 percent
Wet	12.4 percent	13.0 percent	- 0.6 percent
Above Normal	6.6 percent	7.6 percent	- 0.9 percent
Below Normal	6.2 percent	5.8 percent	0.4 percent
Dry	7.5 percent	7.5 percent	0.0 percent
Critical	15.8 percent	14.2 percent	1.6 percent

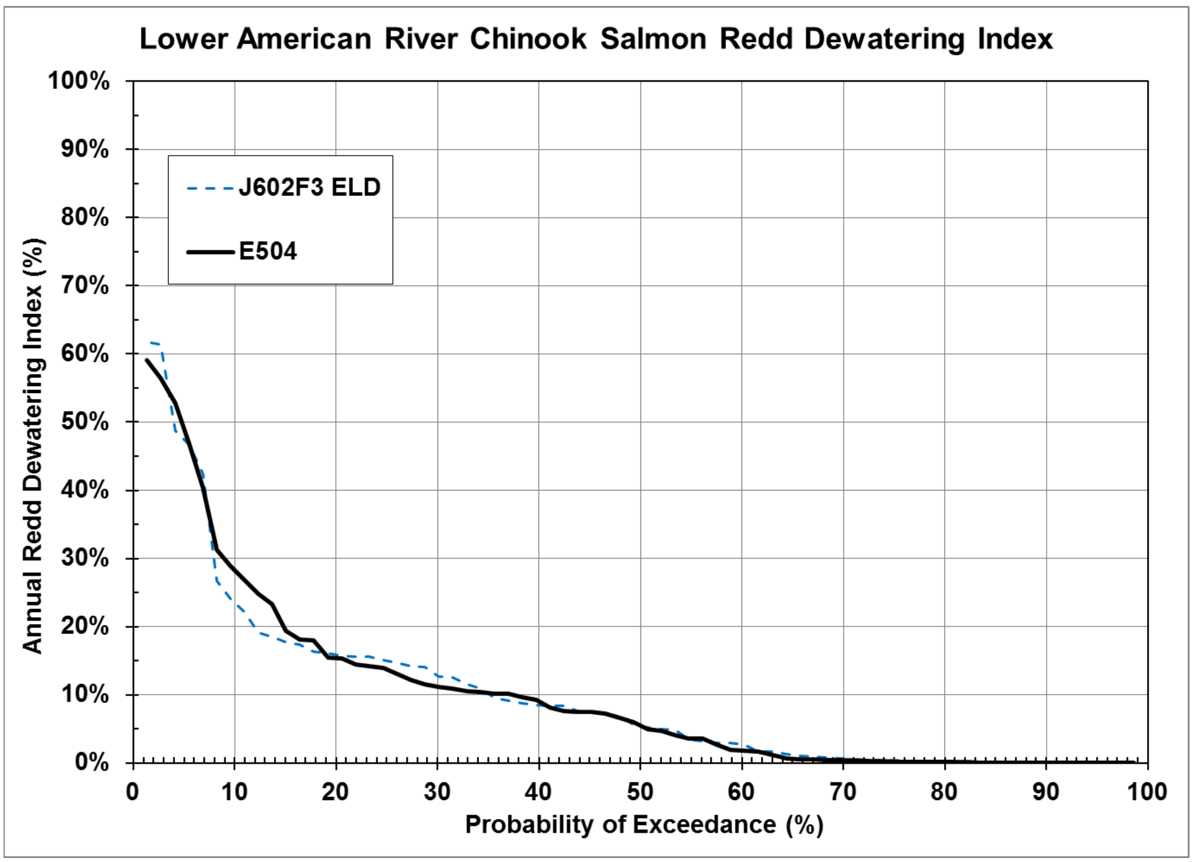


Figure 4-31. Fall-run Chinook Salmon Redd Dewatering Index Exceedance Distribution under Alternative 2 - Forecast-informed Operations and No Action/No Project Conditions.

Table 4-35. Long-term Average and Average by Water Year Type Fall-run Chinook Salmon Early Lifestage Mortality.

Lower American River Chinook Salmon Annual Redd Dewatering Index Averages (percent)			
Water Year Type Category	**Alternative 2 - Forecast-informed Operations**	**No Action/No Project**	**Difference**
All Water Years	7.5 percent	7.7 percent	–0.2 percent
Wet	4.6 percent	4.6 percent	0.0 percent
Above Normal	4.1 percent	4.1 percent	–0.1 percent
Below Normal	4.9 percent	5.1 percent	–0.2 percent
Dry	10.9 percent	11.6 percent	–0.6 percent
Critical	14.9 percent	14.8 percent	0.1 percent

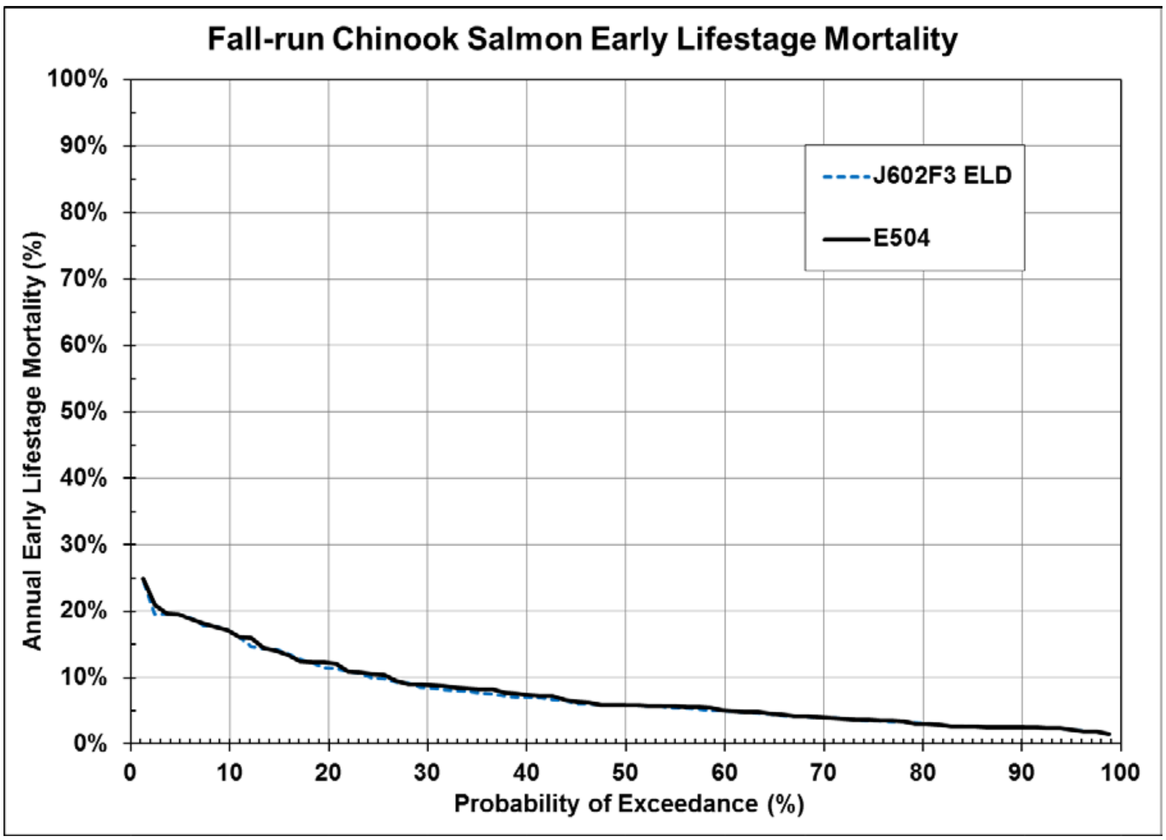


Figure 4-32. Fall-run Chinook Salmon Annual Early Lifestage Mortality Exceedance Distribution under Alternative 2 - Forecast-informed Operations and No Action/No Project Conditions.

Overall, in consideration of all flow and water temperature-related indicators of potential impact, as well as peak lifestage-specific temporal considerations, and limiting factors and key stressors for salmonids in the lower American River, habitat conditions are expected to be generally similar for fall-run Chinook salmon under Alternative 2 - Forecast-informed Operations relative to No Action/No Project. Although flows decrease more often during migration and rearing lifestages, spawning habitat availability and early lifestage mortality are similar under both scenarios, and the probability of redd dewatering is similar or slightly reduced under Alternative 2 - Forecast-informed Operations. In addition, Alternative 2 water temperatures are cooler on average during spring, summer and fall months. These cooler temperatures can improve larval survival in redds.

With less use of the variable space flood storage and greater capacity to capture spring-refill, Alternative 2-Forecast-informed operations provides Reclamation more flexibility in managing conservation storage to meet Fall-run Chinook salmon lifestage requirements than does the No Action/No Project operations. While model results show beneficial and adverse effects to meeting Fall-run Chinook salmon lifestage requirements, Alternative 2 provides greater potential for stored water to be managed by Reclamation to meet these requirements than does the No Action/No Project condition. Therefore, affects to Fall-run Chinook salmon in the lower American River would be considered less than significant.

Spring-run Chinook Salmon (non-natal juvenile rearing)

Overall, in consideration of all flow and water temperature-related indicators of potential impact, habitat conditions are expected to be similar for spring-run Chinook salmon under Alternative 2 - Forecast-informed Operations relative to No Action/No Project. Although flows decrease more often, water temperature index values are exceeded with similar frequency as shown in Table 4-36. In addition, flow reductions are not expected to substantially affect the incidental rearing of non-natal juvenile spring-run Chinook salmon in the lower American River when seeking refuge from high winter flows in the Sacramento River.

Table 4-36. Net Difference in Water Temperature Index Value Exceedance Probabilities for Spring-run Chinook Salmon.

Spring-run Chinook Salmon in the Lower American River																	
Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric	Range	Net Change in Probability of Exceedance under With-Project (Alternative 2 - Forecast-informed Operations) relative to the No Action/No Project Condition (No Action/No Project Condition)											
			Description	Value (°F)		Oct	Nov	Dec	Jan	Feb	Mar	Apr	Ma	Jun	Jul	Aug	Sep
Non-Natal Juvenile Rearing	November through April	Mean Daily Water Temperature (°F)	Mouth of the American River (RM 1)	61	All Years		0	0	0	0	0	1					
				65	All Years		0	0	0	0	0	1					

With less use of the variable space flood storage and greater capacity to capture spring-refill, Alternative 2-Forecast-informed operations provides Reclamation more flexibility in managing conservation storage to meet Spring-run Chinook salmon (non-natal juvenile rearing) lifestage requirements than does the No Action/No Project operations. While model results show beneficial and adverse effects to meeting Spring-run Chinook salmon (non-natal juvenile rearing) lifestage requirements, Alternative 2 provides greater potential for stored water to be managed by Reclamation to meet these requirements than does the No Action/No Project condition. Therefore, affects to Spring-run Chinook salmon (non-natal juvenile rearing) in the lower American River would be considered less than significant.

Spawning Gravel Mobilization

Bed mobilization is contingent on grain size, channel geometry and flow (or discharge) rate. Flows <7,000 cfs can mobilize and move fines, silts, sand. The trend is correlated between larger flows mobilizing larger bed elements such as gravel, and small and large cobble. The typical flow where spawning gravel bed mobilization can start is around 35,000 cfs. Overall, the number of days over the 82-year period of analysis when flows would equal or exceed 30,000 cfs would decrease from 158 days to 115 days with the Alternative 2 - Forecast-informed operations than with the No Action/No Project Condition. However, the number of days when flows could cause full bed mobilization (ie.40,000 to 80,000 cfs) increase from 40 days to 68 days for Alternative 2 - Forecast-informed operations than with the No Action. These data are summarized in Table 4-37 and overall discharge frequencies are presented in Table 4-38.

Bed mobilization begins in the 30,000 cfs to 40,000cfs range, and peaks in the 40,000 cfs to 80,000 cfs range depending on river channel geometry. Flows that mobilize the river bed can redistribute silts, fines, sand, cobble, and larger substrate that improves spawning gravel beds for salmonid spawners. Excessively high flows (eg. >80,000 cfs) or repeated, multiple flow events in a single season that result in full bed mobilization could also trigger bed coarsening. Bed coarsening is the loss of smaller substrate material, in this case, suitable for spawning. The opposite of bed coarsening is the infill of spawning gravel beds by silts, fines and sand. Dam development has resulted in both aggradation and degradation (coarsening) over time, which has led to spawning gravel augmentation programs on many Sacramento-San Joaquin watershed rivers.

HEC-6T model results (see Section 4.2) did not account for existing CVPIA spawning gravel augmentation programs. The POR result is a degradational trend in the subreaches (1-4) just below Nimbus Dam that averages 6,700 to 9,100CY of bed material annually, and aggradation in the lower subreaches to the Sacramento River (5-10) that averages 1,800 to 6,100CY. On the American River, the CVPIA requires USBR to implement and study gravel augmentation programs. USBR began spawning gravel augmentation in 2008 and has continued these efforts every year since except for 2015. The average annual placement is 10,000CY of spawning gravel material with a range of 5,000 to 35,000CY (USBR 2016). This CVPIA spawning gravel effort is independent of the Manual Update, will continue into the future, and will continue to improve the spawning gravel volume and availability within the lower American River system. However, as part of the WCM operations, SAFCA will supplement the existing gravel augmentation program to compensate for the potential loss of approximately 300 short tons/year of spawning gravel that could occur from increased mid-range (30,000-80,000cfs) flows following implementation of Alternative 2. SAFCA will also establish or contribute to a monitoring program to evaluate movement of spawning gravel in the upper reaches of the lower American River. Under Alternative 2, releases between 30,000 and 80,000 cfs will be minimized to reduce erosion of spawning gravel, when conditions warrant.

Table 4-37. Spawning Gravel Mobilization Flows Comparison of No Action/No Project Condition and Alternative 2 - Forecast-informed operations.

Mobilization Flow Range	No Action/No Project Condition			Alternative 2 - Forecast-informed operations				Change (days)
	# of Day s	% of POR (29,578 days)	% Moblization Flow Range (158 days)	# of Days	% of POR (29,578 days)	% Moblization Flow Range (115 days)	% Diff Mobilization Flow Range	
# of 1-day average flows Below Nimbus that are ≥ 30,000 cfs but <40,000 cfs	109	0.37%	68.99%	40	0.14%	34.78%	-63.30%	-69
# of 1-day average flows Below Nimbus that are ≥ 40,000 cfs but <50,000 cfs	22	0.07%	13.92%	39	0.13%	33.91%	77.27%	17
# of 1-day average flows Below Nimbus that are ≥ 50,000 cfs but <60,000 cfs	8	0.03%	5.06%	15	0.05%	13.04%	87.50%	7
# of 1-day average flows Below Nimbus that are ≥ 60,000 cfs but <70,000 cfs	6	0.02%	3.80%	3	0.01%	2.61%	-50.00%	-3
# of 1-day average flows Below Nimbus that are ≥ 70,000 cfs but <80,000 cfs	4	0.01%	2.53%	11	0.04%	9.57%	175.00%	7
# of 1-day average flows Below Nimbus that are ≥ 80,000 cfs	9	0.03%	5.70%	7	0.02%	6.09%	-22.22%	-2
# of 1-day average flows Below Nimbus that are peak mobilization flows ≥ 40,000 cfs but <80,000 cfs	40	0.14%	25.32%	68	0.23%	59.13%	70.00%	28
Total days ≥30,000 cfs	158	0.53%	100%	115	0.39%	100%	-27.22%	-43

Independent of the CVPIA spawning gravel project(s), bed mobilization should also improve under Alternative 2 implementation. Table 4-37 identifies little change in flow regimes <10,000 cfs and an increase in flows from 10,000 cfs to 20,000 cfs. While some small grain size elements are necessary, to much siltation resulting from too low of flows or lack of flushing flows can be a negative. These two discharge rate intervals indicate a neutral to beneficial effect on small grain size mobilization that could result in less aggradation of silts, fines and sands over spawning gravel beds.

The bed mobilization data from Table 4-38 is more complex. The decrease from 158 days to 115 days above 30,000 cfs is not consistent across discharge rate intervals. At the low end where bed mobilization can initiate, Alternative 2 would result in a 63% decrease in 30-40,000 cfs flows compared to the No Action. While this is can be viewed as a significant decrease, the change in days is considered to be a neutral impact on overall bed mobilization because this is the flow range where spawning gravel may start to move dependent on channel geometry but still displace smaller silts and fines from causing a siltation problem. In addition, a decrease in days for this flow interval could also be a beneficial effect as large sand and small gravel sized material is mobilized less frequently resulting in less bed coarsening.

As flows increase above 40,000 cfs, there is a general, albeit small by days but significant percentage wise, increase in the number of days for each interval relative to implementation of Alternative 2 versus the No Action. Overall, the flow intervals where bed mobilization occurs most frequently (i.e. 40,000 cfs to 80,000 cfs) increases from 40 days to 68 days under Alternative 2, which is a 70% increase. Over the entire period of record, this is a positive increase from 0.14% to 0.23% of total days. Above 80,000 cfs where bed mobilization can lead to coarsening, there is a decrease from 9 days to 7 days. Potentially increasing bed mobilization and decreasing coarsening is a significant beneficial effect to ongoing gravel augmentation programs and the Manual Update. Ongoing CVPIA spawning gravel augmentation programs require flows in the 40,000 to 80,000 cfs range to move and redistribute small and large cobble that has placed in the river bed. This redistribution creates more natural spawning bed habitat(s) in the immediate vicinity of the augmentation project area and downstream. The decrease in flows >80,000 cfs is an improvement retaining more of the augmented material within the lower American River system versus movement into the Sacramento River channel.

Table 4-38. Modeled Average Daily Discharge Frequencies for No Action/No Project and Alternative 2 – Forecast-informed Operations.

Discharge Range (cfs)	No Action/No Project Discharge Frequencies (# of days)	Alternative 2 – Forecast-informed Operations Discharge Frequencies (# of days)
< 10,000	28,388	28,348
10,000 to < 20,000	830	967
20,000 to < 30,000	202	147
30,000 to < 40,000	109	40
40,000 to < 50,000	22	39
50,000 to < 60,000	8	15
60,000 to < 70,000	6	3
70,000 to < 80,000	4	11
80,000 to < 90,000	1	3
90,000 to < 100,000	2	1
100,000 to 115,000	6	4

Therefore, the overall effects on spawning gravel mobilization are considered to be an improvement over the existing No Action/No Project alternative, and negligible to less than significant with the continued implementation of USBR's CVPIA spawning gravel augmentation program and SAFCA's supplementation of 300 short tons/year, as well as additional monitoring of spawning gravel in the upper reaches of the lower American River.

Regional Effects Assessment Area Special Status Fisheries

The species and lifestage-specific interpretive comparisons below are based on numerous output provided in Appendix D, including: (1) long-term average and average by water year type riverine flows on a monthly basis; (2) monthly riverine flow exceedance distributions; (3) monthly water temperature exceedance distributions in relation to specific water temperature index values; (4) long-term average and average by water year type annual spawning habitat availability for anadromous salmonids; (5) annual spawning habitat availability exceedance distributions for anadromous salmonids; (6) long-term average and average by water year type monthly Delta outflow, Old and Middle River flow, and Delta exports; (7) monthly exceedance distributions for Delta outflow, Old and Middle River flow, and Delta exports; (8) long-term average and average by water year type monthly X2 location; and (9) monthly X2 location exceedance distributions.

In addition, simulated monthly water temperatures at representative nodes in the rivers in the Project Area indicate that water temperatures under Alternative 2 relative to No Action/No Project would generally be: (1) equivalent or similar most of the time in the Sacramento River, but would be measurably cooler slightly more often in August, and measurably warmer slightly more often in June and July below Keswick Dam, and measurably warmer slightly more often during July at Bend Bridge and below the Feather River confluence; and (2) equivalent or similar most of the time in the Feather River below the Thermalito Afterbay Outlet and at the mouth (Table 4-39 to Table 4-41).

Table 4-39. Comparison of Water Temperatures in the Regional Effects Assessment Area between Alternative 2-Forecast-Informed Operations and No Action/No Project.

River and Location	Long-term and Water Year Type Average Water Temperature					
	Long-term	Wet	Above Normal	Below Normal	Dry	Critical
Sacramento River below Keswick Dam	✓	✓	✓	✓	✓	✓
Sacramento River at Bend Bridge	✓	✓	✓	✓	✓	✓
Sacramento River at Feather River confluence	✓	✓	✓	✓	✓	✓
Sacramento River at Freeport	✓	✓	✓	✓	✓	✓
Feather River below Thermalito Afterbay Outlet	✓	✓	✓	✓	✓	✓
Feather River at the mouth	✓	✓	✓	✓	✓	✓

Table 4-40. Water Temperature – Net Measurable Differences over Entire Monthly Exceedance Distributions.

River and Location	Entire Monthly Exceedance Distributions
Sacramento River below Keswick Dam	✓
Sacramento River at Bend Bridge	✓
Sacramento River at Feather River confluence	✓
Sacramento River at Freeport	✓
Feather River below Thermalito Afterbay Outlet	✓
Feather River at the mouth	✓

Table 4-41. Water Temperature – Net Measurable Differences over Warmest 25 percent of Monthly Exceedance Distributions

River and Location	Warmest 25 percent of the Monthly Exceedance Distributions
Sacramento River below Keswick Dam	Net measurable decrease in Aug; net increase in Jun & Jul
Sacramento River at Bend Bridge	Net measurable increase in Jul
Sacramento River at Feather River confluence	Net measurable increase in Jul
Sacramento River at Freeport	✓
Feather River below Thermalito Afterbay Outlet	✓
Feather River at the mouth	✓

Note: "✓" refers to similar values of the evaluation metric for both scenarios.

A closer look at the exceedance probability plots of the modeled temperature outputs below Keswick Dam for June shows that Alternative 2 had minor occurrences of temperature increase in the 5 percent probability range, as shown in Figure 4-33. However, temperatures for both operation scenarios did not exceed 51.5 degrees Fahrenheit at this low probability and would not represent a stressor to fish at that temperature.

Similarly, July temperatures below Keswick Dam also indicated a slight shift in temperature at the 12 to 15 percent probability (Figure 4-34). However, those temperature shifts are also occurring around the 51 degrees Fahrenheit range and would also not represent a significant stressor to listed fish. The same consideration holds true for differences in water temperature for the month of July at Bend Bridge, where temperatures represent a shift of up to 0.7 degrees Fahrenheit, but with both operation scenarios remaining below 63 degrees (Figure 4-35).

In Figure 4-36, temperatures on the Sacramento River below the Feather River confluence show markedly warmer temperatures than the locations further upstream for both No Action/No Project and Alternative 2 operation conditions. At this location Alternative 2 did show a slight increase in temperatures of between 0.4 and 0.7 degrees Fahrenheit. Given the relatively infrequent nature of these occurrences and the minor difference in temperatures, the performance of both operations would be considered consistent with each other.

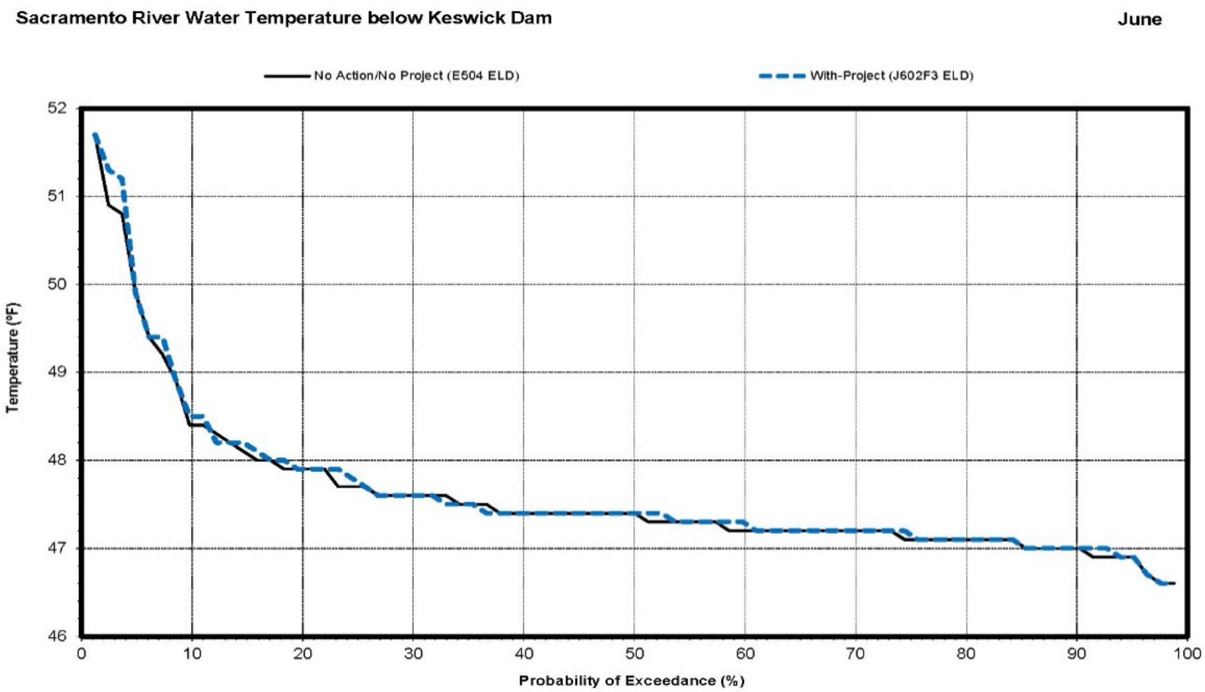


Figure 4-33. Exceedance Probability Plot of June Sacramento River Water Temperature below Keswick Dam – No Action/No Project compared to Alternative 2.

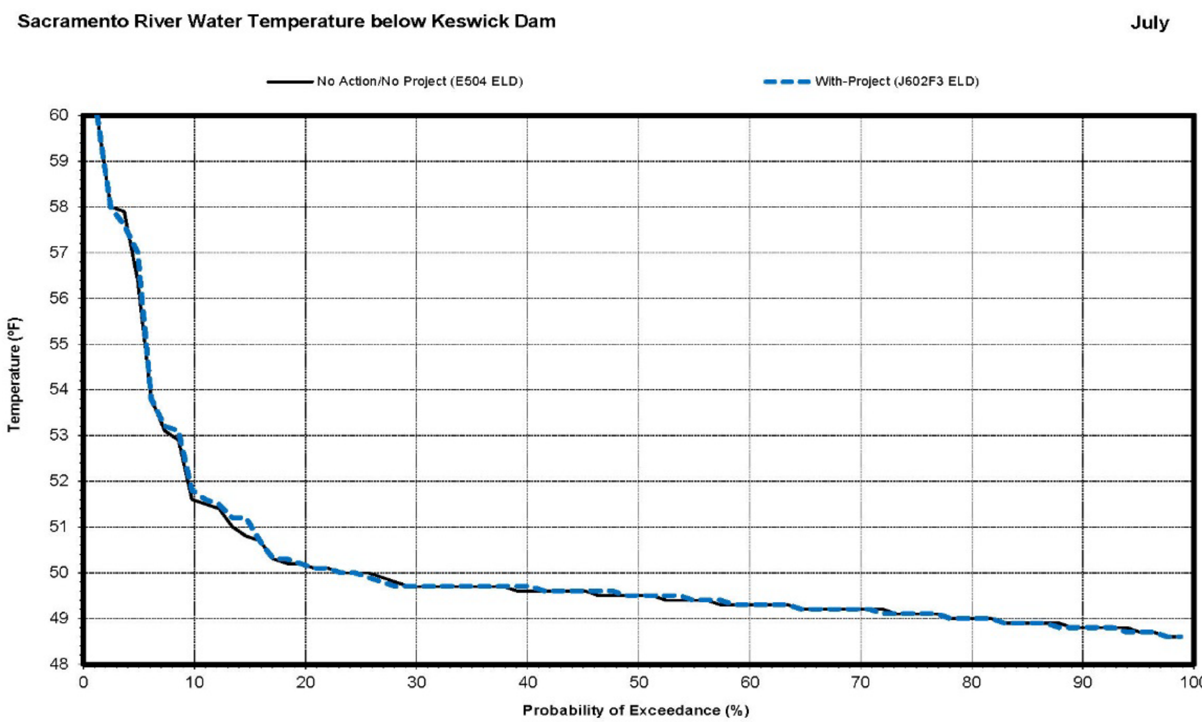


Figure 4-34. Exceedance Probability Plot of July Sacramento River Water Temperature below Keswick Dam – No Action/No Project compared to Alternative 2.

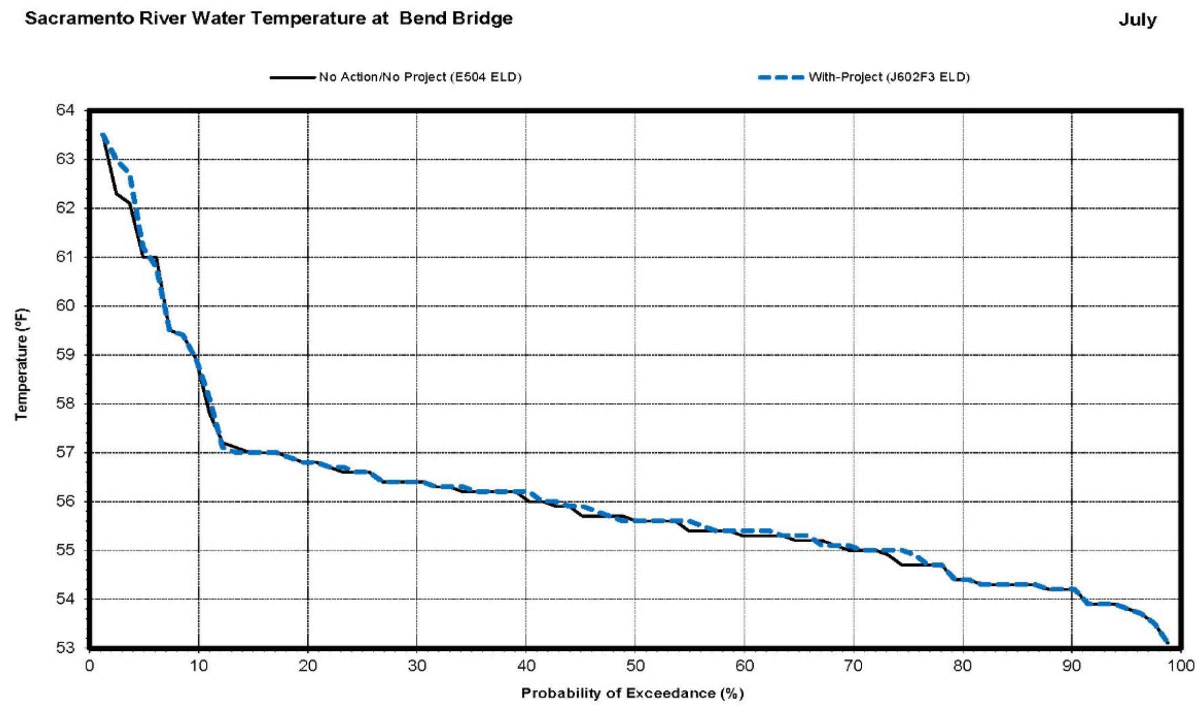


Figure 4-35. Exceedance Probability Plot of July Sacramento River Water Temperature at Bend Bridge – No Action/No Project compared to Alternative 2.

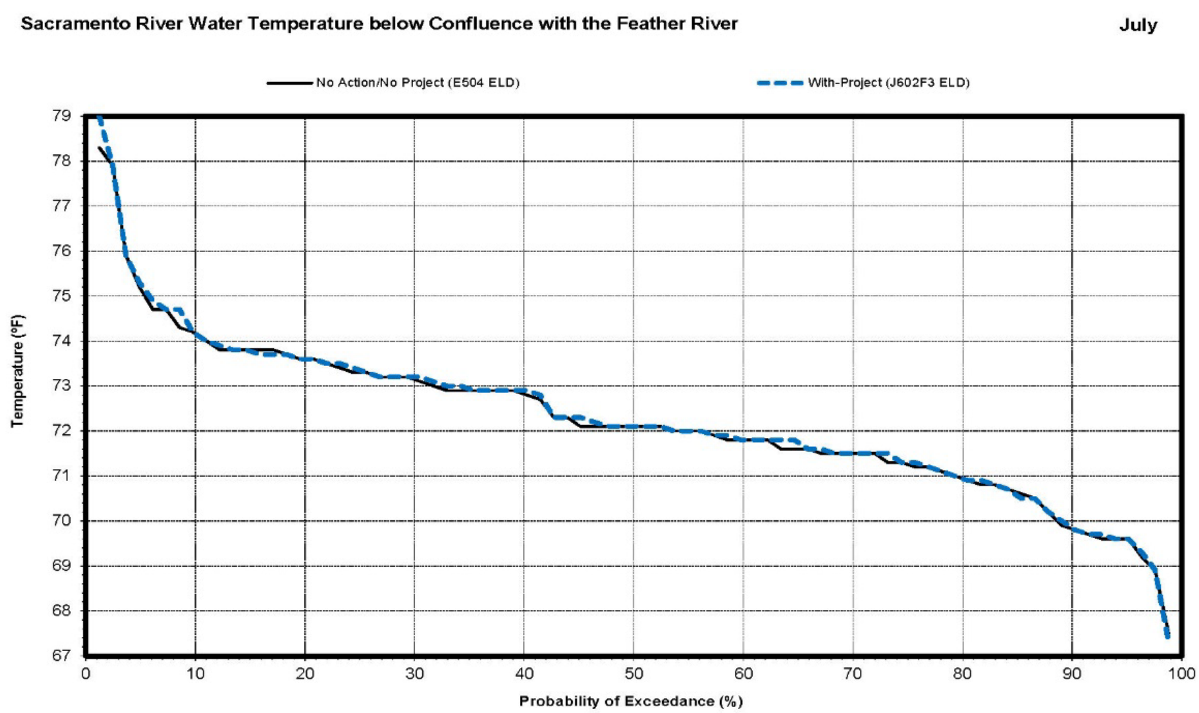


Figure 4-36. Exceedance Probability Plot of July Sacramento River Water Temperature below the Confluence with the Feather River – No Action/No Project compared to Alternative 2.

Sacramento River

On the Sacramento River, flow and water temperature model results were evaluated for salmonid species below Keswick Dam, at Ball's Ferry, at Jelly's Ferry, at Bend Bridge, at Red Bluff, at Verona, below the Feather River confluence, and at Freeport. In addition to flow and water temperature modeling, model results for spawning habitat availability (weighted usable area, or WUA) for salmonid species were also evaluated.

In particular, flows modeled were consistent with the modeling results from the 2016 Coordinated Long Term Operation of the Central Valley Project and State Water Project EIS. As shown in Appendix D, modeled results for long-term average flows, average flows by water year type, and flow exceedance probabilities during all years and during low-flow conditions were equivalent for the Folsom WCM alternatives relative to the No Action/No Project condition. These model results were incorporated into the impact determinations for spring-run Chinook salmon, fall-run Chinook salmon, steelhead, river lamprey, Pacific lamprey, and hardhead.

Feather River

Flow and water temperature model results for salmonid species were also evaluated on the Feather River below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the Feather River. As on the Sacramento River model results for spawning habitat availability (WUA) for salmonid species were also evaluated on the Feather River.

In particular, flows in the Low Flow Channel below the Fish Barrier Dam were modeled consistent with the terms of the California Department of Water Resources' agreement with the California Department of Fish and Wildlife. As shown in Appendix D, modeled results for long-term average flows, average flows by water year type, and flow exceedance probabilities during all years and during low-flow conditions were equivalent for the Folsom WCM alternatives relative to the No Action/No Project condition. These model results for the Low Flow Channel below the Fish Barrier Dam were incorporated into the impact determinations for spring-run Chinook salmon, fall-run Chinook salmon, steelhead, river lamprey, Pacific lamprey, and hardhead.

Sacramento-San Joaquin Delta and Yolo Bypass

Species having special life-stage condition requirements in the Delta and Yolo Bypass were also evaluated. Model results for OMR flows and X2 location were considered in the effects determination for Delta smelt and longfin smelt. In addition, Delta outflow and water temperatures in the Sacramento River at Freeport were also evaluated for effects to Delta smelt.

For all runs of Central Valley Chinook salmon and Central Valley steelhead model outputs for Sacramento River flows at Rio Vista, Yolo Bypass outflow, Delta outflow, and OMR flows were evaluated. OMR flows were also evaluated for affects to adult San Joaquin River fall and late fall-run Chinook salmon. In addition, Yolo Bypass outflow was evaluated for Delta smelt, splittail, green sturgeon, and white sturgeon.

Model results for exports were examined at the SWP and CVP export facilities. The model results showed that: (1) long-term average monthly total SWP and CVP Delta exports are generally equivalent year-round; (2) average total Delta exports by water year type are generally equivalent, except for some slight increases (up to 1.0 percent) during some months of above-normal water years and decreases (up to 0.5 percent) during some months of dry water years; and (3) monthly exceedance distributions are generally similar year-round, with the exception of September when exports increase somewhat over about 20 percent of the distribution. Therefore, no further evaluations were conducted to evaluate fish salvage at the SWP and CVP export facilities.

Overall Effects to Regional Effects Assessment Area Fisheries

With less use of the variable space flood storage and greater capacity to capture spring-refill, Alternative 2-Forecast-informed operations provides Reclamation more flexibility in managing conservation storage to meet regional effects assessment area fisheries than does the No Action/No Project operations. While model results for individual months between individual water years show percent increases and decreases in excess of the 5 percent modeling threshold, the overall effects are negligible to less than significant and meet regional fisheries requirements. Alternative 2 provides greater potential for stored water to be managed by Reclamation and DWR to meet these requirements than does the No Action/No Project condition. Therefore, affects to regional effects assessment area fisheries would be considered consistent with existing CVP-SWP operations, any differences are simply minor fluctuations due to model assumptions and approaches, and are thus negligible to less than significant.

Future Level of Demand

The 2016 Coordinated Long Term Operation of the Central Valley Project and State Water Project EIS modeling evaluated all contractors/purveyors at full contract value and included prior water rights, and settlement agreements, which is consistent with what the Manual Update refers to as a "future level of demand". Because the 2016 EIS were alternatives evaluated against implementation of the 2008/2009 USFWS-NMFS BO's, if the Alternative 2 and/or No Project/No Action Alternative are similar and consistent with the CVP-SWP CalSim II modeling for the 2016 EIS, then either alternative is consistent with the BO's and has a less than significant effect.

Overall, in consideration of all flow and water temperature–related impact indicators, as well as peak lifestage-specific temporal considerations, and limiting factors and key stressors for steelhead in the lower American River, habitat conditions are expected to be more suitable for steelhead under Alternative 2 future level of demand (J602F3 FLD) relative to the No Project/No Action Alternative future level of demand (J604). There are slight variations where flows decrease more often during February, flows increase more often during other months of the year, the probability of redd dewatering is reduced, spawning habitat availability increases, and water temperatures are reduced more often during the warmest months of the juvenile rearing period. These differences are below the 5 percent threshold for model variability, which is the same threshold used in the 2016 EIS modeling analysis. Therefore, key stressors to fisheries in the local and regional areas are negligible to less than significant under the Alternative 2 future condition relative to the No Action/No Project future condition. See Appendix D and Appendix H.

Cumulative

Two foreseeable cumulative projects each has a potential different effect on the local project area in conjunction with the Manual Update. The Folsom Dam Raise project would result in negligible to beneficial effects downstream on lower American River fisheries resources. The ability to use the dam's auto shutters would improve ability to meet downstream, cold-water temperature requirements. The West Sacramento Flood Control project would have a beneficial effect through the reduction of erosion and sedimentation, which impact riparian and aquatic habitats alike. Overall, these two projects would have a negligible to beneficial effect in conjunction with the Manual Update.

4.5.3 Mitigation

No mitigation is considered necessary.

4.6 Water Supply and Deliveries

4.6.1 Environmental Setting/Affected Environment

Local Project Area

The 2006 American River Division Long Term Contract Renewal EIS and 2016 Coordinated Long Term Operation of the Central Valley Project and State Water Project EIS generally characterizes the local project area's water supply, delivery and distribution systems. This includes CVP contractors, prior water rights, and settlement agreements, and delivery locations at the dam, American River pump station, and downstream, releases. For this resource, water supply and deliveries to American River purveyors are considered as at full contract value.

Regional effects Assessment Area

The Hydrology and Water Quality discussion in Section 5 of the 2016 Coordinated Long Term Operation of the Central Valley Project and State Water Project EIS generally characterizes the regional project area's water supplies and deliveries. For this resource, supply and delivery focuses on north of the delta deliveries and delta exports. While Alternative 2 modeling shows slight increases and decreases across months and between water year types for both Shasta and Oroville reservoir storages when compared to No Action/No Project outputs, the relatively minor changes overall in conservation storage volumes at Shasta, and Oroville are less than one percent. In addition, annual CVP and SWP deliveries are generally similar for the two Folsom operation scenarios modeled. Because of the higher Folsom Reservoir storages and changes in the allocations in the CalSim II modeling, long-term average annual deliveries show only slight variability. Modeling results for reservoir storage levels and deliveries indicate the 5 percent threshold of significance is not exceeded. Therefore, regional area effects are not discussed in detail. Please refer to Appendix E for additional information.

4.6.2 Environmental Consequences

The following section summarizes the evaluation of effects of Alternative 2 – Forecast-informed Operations on water supply and distribution as it relates to Folsom Reservoir and the larger CVP/SWP system. A detailed discussion of the methodology, modeling approach, and results can be found in Appendix E.

Methodology

Effects to water supply were evaluated as they relate to water deliveries for M&I, agricultural, settlement agreements, and wildlife refuge uses. The water delivery evaluation is based on metrics related to the Folsom Dam and Reservoir's beneficial uses as reflected in the output from CalSim II models. A comparative analysis was made between the CalSim II period of record outputs from Alternative 2 and No Action/No Project to identify changes in water supply and delivery that would be a result of changes in flood operations at Folsom Dam.

CalSim II outputs were evaluated as long-term average values (period of record) as well as by water year type to account for effects that are more pronounced in one water year type versus another. Further evaluation was carried out to address specific parameters based on their importance in characterizing effects within the local project area as related to American River purveyors.

Basis of Significance

Effects to local water supply were considered to be significant if they substantially altered. A change of 5 percent or more is considered significant:

- End-of-month storage in Folsom Reservoir; or,
- Deliveries to American River purveyors.

No Action/No Project

Under No Action/No Project, Folsom Dam and Lake would continue to operate under the 2004 Interim Agreement. The new auxiliary spillway would not be utilized except in extremely rare circumstances that threaten the structural integrity of Folsom Dam. Release schedules for Folsom Dam would remain the same. Folsom Lake would continue to be required to reduce the water conservation pool starting October 1 to accommodate the variable flood storage requirements of between 400,000 af and 670,000 af at the peak of the flood season. Existing conditions would be expected to remain relatively unchanged. Contractual commitments detailed in the 2004 Interim Agreement and 2006 American River Division Long Term Contract Renewal EIS would continue, and as described in Section 3.1.1.

Alternative 2 – Forecast Informed Operations with Variable Folsom Flood Control Space (400,000 af to 600,000 af)

Local Project Area

In general, model outputs for storage in Folsom Reservoir for Alternative 2 - Forecast-informed Operations are higher than No Action/No Project. CalSim II Folsom Reservoir end-of-month storage volumes for the period of record analysis are shown in Table 4-42 for both long-term averages and by water year type. CalSim II model outputs indicate that the overall condition with the forecast operations in place at Folsom Dam would be generally similar or better than conditions with existing operations at Folsom. Only August and September storage amounts in critical water years were measurably lower.

The top-of-conservation-pool storage volumes computed from inflow-forecast-based operations for Alternative 2 prescribe higher maximum allowable storages in November through April months than the No Action/No Project model. As a result, the model is storing more water in these winter months and releasing it in summer. Storage in Folsom Reservoir is higher in May, implying better availability of water to meet summer water delivery obligations and Folsom releases through the summer. As summarized in Table 4-43, project water deliveries to the lower American River purveyors are generally similar with some increases and decreases, but showing a slightly more increases.

With less use of the variable space flood storage and greater capacity to capture spring-refill, Alternative 2-Forecast-informed operations provides Reclamation more flexibility in managing conservation storage to meet water supply and delivery needs than does the No Action/No Project operations. Model results show change in reservoir management is variable and can result in monthly supply increases and decreases as noted in Tables 4-42 and 4-43. The decreases do not meet the 5 percent significance threshold. Increased storage is considered a beneficial impact both in meeting supply demands and providing more flexibility in meeting water quality (temperature) parameters for sensitive/listed species (see Appendix E for complete discussion of results). Therefore, overall effects to water supply and demand in the local project area would be considered less than significant.

Table 4-42. Long-term and Water Year Type Average of Folsom Reservoir End of Month Storage Under No Action/No Project (E504 ELD) and Alternative 2 - Forecast-informed (J602F3 ELD) Operations.

Analysis Period	Average Storage (TAF)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-term												
Full Simulation Period[2]												
No Action/No Project (E504 ELD)	490	441	451	469	487	594	722	845	819	682	611	540
With-Project (J602F3 ELD)	491	447	467	495	538	627	738	856	829	687	615	542
Difference	1	6	16	26	51	33	16	11	10	5	4	2
Percent Difference[3]	0.2	1.4	3.5	5.5	10.5	5.6	2.2	1.3	1.2	0.7	0.7	0.4
Water Year Types[1]												
Wet												
No Action/No Project (E504 ELD)	518	468	500	505	490	623	784	958	957	872	773	646
With-Project (J602F3 ELD)	518	479	537	563	598	664	793	964	963	878	779	651
Difference	0	11	37	58	108	41	9	6	6	6	6	5
Percent Difference	0.0	2.4	7.4	11.5	22.0	6.6	1.1	0.6	0.6	0.7	0.8	0.8
Above Normal												
No Action/No Project (E504 ELD)	471	407	425	497	515	637	788	960	938	752	697	565
With-Project (J602F3 ELD)	472	424	448	541	582	688	809	967	944	757	700	565
Difference	1	17	23	44	67	51	21	7	6	5	3	0
Percent Difference	0.2	4.2	5.4	8.9	13.0	8.0	2.7	0.7	0.6	0.7	0.4	0.0
Below Normal												
No Action/No Project (E504 ELD)	507	467	464	506	541	633	782	921	898	693	655	628
With-Project (J602F3 ELD)	504	465	462	504	569	659	797	929	903	697	658	628
Difference	-3	-2	-2	-2	28	26	15	8	5	4	3	0
Percent Difference	-0.6	-0.4	-0.4	-0.4	5.2	4.1	1.9	0.9	0.6	0.6	0.5	0.0
Dry												
No Action/No Project (E504 ELD)	489	443	451	451	494	596	703	779	714	551	480	463
With-Project (J602F3 ELD)	488	442	451	451	501	628	734	803	738	561	489	469
Difference	-1	-1	0	0	7	32	31	24	24	10	9	6
Percent Difference	-0.2	-0.2	0.0	0.0	1.4	5.4	4.4	3.1	3.4	1.8	1.9	1.3
Critical												
No Action/No Project (E504 ELD)	433	381	357	350	376	436	478	501	468	383	320	297
With-Project (J602F3 ELD)	439	387	365	357	384	446	487	509	476	383	314	291
Difference	6	6	8	7	8	10	9	8	8	0	-6	-6
Percent Difference	1.4	1.6	2.2	2.0	2.1	2.3	1.9	1.6	1.7	0.0	-1.9	-2.0

1 As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995)

2 Based on the 82-year simulation period

3 Relative difference of the monthly average

Table 4-43. American River Purveyors Deliveries for Alternative 2 - Forecast-informed Operations vs. No Action/No Project.

Evaluation Parameters	Evaluation Metrics and Summary of Effects	Results		
American River Purveyors Deliveries				
Purveyor Delivery Type		**Monthly Average, Maximum, and Minimum Deliveries**		
		Average	**Maximum**	**Minimum**
American River Pump Station deliveries to PCWA	Long-term monthly average, maximum and minimum deliveries – potential reservoir management flexibility could result in some increases and decreases as noted.	✓	✓	✓
City of Folsom deliveries		1 AF increase for March through October months. No change in other months.	1 AF increase in April	5 AF increase in April; 1 AF decrease in July.
City of Roseville deliveries		Up to 6 AF increase for all months.	✓	23 AF increase in April.
San Juan Water District deliveries		✓	✓	✓
SSWD deliveries from Folsom		✓	✓	✓
Folsom Pumping Plant deliveries		3 AF – 9 AF increase for all months.	✓	33 AF increase in April and 3–4 AF decrease in July and August.
FWTP deliveries		31 AF increase for April.	214 AF increase in April	✓
Freeport Pumping Plant deliveries		8 AF decrease in June. 53 AF decrease in August. Similar for all other months.	69 AF decrease in April and 6 AF decrease in June.	✓
August 1977 deliveries – City of Roseville, San Juan Water District, and City of Folsom		✓	N/A	N/A

Note: "✓" refers to the same value of the evaluation metric for both scenarios.
See Appendix E for full analysis.

Future Level of Demand

Alternative 2 model results were compared to the No Action/No Project condition, with an estimated future level of water demand within the regional effects assessment area through year 2033 applied to both CalSim model constructs (see Appendix A). CalSim II model outputs for the No Action future conditions and Alternative 2, Future Level of Demand indicate that, overall, Alternative 2 would be generally similar to or better than the No Action future condition. There could be some occurrences of slight increases and decreases in evaluation metrics, as expected with any changes in the CalSim II models. A detailed explanation of how future levels of demand are represented in the CalSim II model is provided in Appendix A.

Model outputs for storage in Folsom Reservoir for Alternative 2, Future Level of Demand are higher than for the No Action future condition. The model is storing more water in November through April and releasing it in summer months implying better availability of water to meet summer water delivery obligations and higher Folsom Reservoir releases through the summer. Therefore, the deliveries produced by Alternative 2, Future Level of Demand were determined to be similar to deliveries from No Action/No Project under future conditions.

Cumulative

The two cumulative projects in Table 4-2 have no operational effects and will not result in any change in water supplies and deliveries.

4.6.3 Mitigation

No mitigation is required.

4.7 Hydropower Production and Distribution

The CVP and SWP systems generate hydroelectric power used to help satisfy their facility power demands and, when a surplus is generated, to sell on the commercial market. Hydroelectric power generation is a secondary operating priority in these systems, behind flood risk reduction, environmental protection and water supply deliveries for municipal, industrial, and agricultural uses, but it plays an important role because the State pursues reductions in greenhouse gases and continues to help meet the power demand from CVP/SWP pumping operations and other facility demands. Accordingly, it is important to determine the effects of modifying the Manual Update on hydroelectric power generation in the CVP/SWP systems.

4.7.1 Environmental Setting/Affected Environment

Folsom Dam is part of the CVP hydropower system that extends from the Cascade Range in the north to the plains along the Kern River approximately 500 miles to the south. The CVP was built primarily to provide the Central Valley with water supply, flood control, and hydropower generation. Hydropower at CVP facilities is an important resource for contributing to the reliability of the electrical power system in California. Impacts to CVP hydropower operations can result from increased water diversions that result in both lower reservoir levels and less water flow through turbines. In addition to potential impacts to electric system reliability, loss of hydropower capacity and generation can also result in indirect environmental affects by necessitating increased power generation using means that are less environmentally benign.

Reclamation's Mid-Pacific Region has eleven hydroelectric powerplants in the CVP with a maximum operation capability of 2,100 megawatts (MW) when all reservoirs are at their fullest (Reclamation 2011). Typically, the CVP generators produce about 4,500,000 MWh in an average water year. Power produced by the CVP hydropower system is used first for meeting project pumping loads. This is termed "pumping for power" at CVP pumping facilities. Commercial power is power produced in surplus to project use and is marketed by WAPA under long-term firm contracts to municipal and government entities (preference customers) at cost-based rates.

Local Project Area

The local hydropower facilities includes Folsom and Nimbus dams, which are part of the overall CVP system, and are included as part of the Regional Effects evaluation.

Regional Effects Assessment Area

The regional area is described in Section 2.1.2 and the 2016 Coordinated Long Term Operation of the Central Valley Project and State Water Project EIS. The Energy discussion in Section 8 of the 2016 Coordinated Long Term Operation of the Central Valley Project and State Water Project EIS generally characterizes the regional project area's existing hydropower facilities for the CVP-SWP. For the regional effects assessment area, a screening-level analysis was carried out to evaluate changes in storage and flow that could effect hydropower production.

Differences in monthly average in-stream flows, both long-term and by water-year type, were evaluated using CalSim II model period-of-record hydrology outputs on the Sacramento River and Feather River. The differences in flow on both rivers was equal to or less than 1% over the entire model period. As stated in Section 4.1, minor fluctuations of up to 5 percent are due to model assumptions and approaches. The CalSim II model run results produced similar conditions. Therefore, short and long-term effects are considered negligible to no effect and do not rise to a level of significance requiring additional analysis and discussion. See Appendix A for a discussion of CalSim II model results.

4.7.2 Environmental Consequences

Methodology

CalSim II period of record hydrology from the No Action/No Project and Alternative 2 – Forecast-informed Operations model builds were applied in the LTGen and SWPGen models to achieve the noted power generation evaluations for the CVP and the SWP, respectively. LTGen and SWPGen are excel spreadsheet-based models developed by Reclamation, WAPA, and DWR to post-process CalSim II output data to calculate monthly values for average capacity and energy production at each power plant as well as monthly average capacity and energy use at each pumping plant. The model output parameters selected for this comparison were based on their historical importance in characterizing the effects on hydropower in the CVP/SWP systems.

The key quantities and metrics provided in the power generation and pump energy use tables consist of long-term and driest-periods' power capacity and energy generation as well as pumping facilities' energy use. These quantities and metrics are expressed as a total of all facilities at load center. These tables are located in Appendix E, Part 2: Monthly Data Products Volume I. The quantities and metrics are expressed as a total of all facilities at load center. A load center is the geographical area where energy is delivered, in this case the WAPA's Tracy transmission area. Net energy generation, which is the remaining generation after removing facilities' energy use, was also quantified. Driest periods represent the annual average of calendar years 1929–1934, 1976–1977, and 1987–1992. Long-term values averaged over the period of record were processed for all parameters to complete the effects analysis on power operations. In addition, long-term monthly averages were determined.

Basis of Significance

Effects to hydropower generation would be considered significant if:

- Temporal distribution changes or reductions in Folsom capacity and energy production that fall below that required to power pumping and other service operations within the American River division.
- Temporal distribution changes, or reductions in net capacity and energy at load center that would potentially generate a secondary greenhouse gas effect of significance by requiring CVP and/or SWP power customers to replace hydroelectric power with that generated by hydrocarbon combustion.

No Action/No Project

Under the No Action Alternative, Folsom Lake and Dam would continue to operate under the existing Water Control Manual. The new auxiliary dam would not be utilized except in .certain circumstances as warranted during flood control operations. Average peak flows, release rates and surface water levels would be expected to remain the same. Release schedules for Folsom Dam would remain the same. Folsom Lake would continue to be required to reduce the water conservation pool up to 400,000 af prior to the start of flood season. There would not be any changes to the current hydropower operations at Folsom or Nimbus Dams and existing conditions would be expected to remain the same.

Alternative 2 – Forecast Informed Operations with Variable Folsom Flood Control Space (400,000 af to 600,000 af)

Hydropower model outputs indicate that the CVP facilities' long-term, monthly, and driest-periods energy generation, capacity, pumping energy use, and net energy generation under the Alternative 2 - Forecast-informed Operations condition would slightly increase relative to the No Action/No Project Condition. However, the magnitudes of these changes would be small, typically a difference of 1 percent or less. Foregone energy would decrease slightly, a change of less than 1 percent. Driest periods' energy generation and net generation would decrease slightly by 1 percent or less. The SWP facilities' energy generation, capacity, and project use for the long-term, monthly, and driest periods would not change or would very slightly decrease for all parameters by less than 1 percent. Foregone energy for both the long-term results and the driest periods' results would increase slightly. Net energy generation at load center in the long-term results would increase slightly, and in the driest periods would decrease slightly.

The CVP and SWP facilities' capacity and generation differences would be due in part to changes to the spring-refill WCD operations under the Alternative 2 - Forecast-informed Operations condition whereby the CalSim II model predicts higher maximum allowable storages in November-through-April, therefore storing more water in spring and releasing it in the summer through the early fall periods. CalSim II models indicate that the resulting Folsom storage would be higher for May through September. November through April releases would decrease accordingly.

The foregone energy increase identified in the SWP driest periods can be attributed to a slightly more rapid drawdown of Oroville Lake during drier years under Alternative 2 - Forecast-informed operations, which leads to the hydropower units at Oroville Dam reaching their minimum generating elevation and becoming unavailable more frequently. The incremental loss of hydropower generation on an average annual basis represents 0.2 percent of the historical average annual generation at Oroville Dam and the incremental impact is marginal when compared against the overall scale of the SWP footprint. In addition, the application of mean monthly flows and reservoir storages in the CalSim II model precludes the ability to quantify daily variations in operations that would be implemented under extreme hydrologic conditions (very wet or very dry) that could occur.

The model results minor increases and decreases in net power generation under Alternative 2 are so small (1 percent range or less) that they are within the bounds of model error and are not considered significant. In addition, these minor changes would not cause an increase or decrease in use of hydrocarbon-based energy generation sources. Implementation of Alternative 2 - Forecast-informed Operations would have a less than a significant effect on hydropower production and distribution, and would not generate a significant change, either positively or negatively, on greenhouse gas emissions.

Future Level of Demand

Similar to existing level of demand, hydropower model outputs indicate that the CVP and SWP facilities' long-term, monthly and driest-periods' energy generation, capacity, pumping energy use, and net energy generation under With-Project Alternative, Future Level of Demand would slightly increase or not change relative to No Action/No Project. The magnitudes of changes would be small, typically a difference of 1 percent or less. Comparisons of the hydropower metrics for the driest periods show a greater variation between the two scenarios, although the changes would typically be 1 percent or less.

Cumulative

The two cumulative projects in Table 4-2 have no operational effects and will not result in any change in hydropower production.

4.7.3 Mitigation

No mitigation required.

4.8 Recreation

This section examines the recreational effects of the various operational scenarios proposed as part of the Manual Update. The focus of the study was on the water-dependent and water-enhanced recreation opportunities for the Folsom Reservoir, the lower American River, Shasta

Dam, and the Sacramento River. The two metrics used to evaluate the recreation resource area were the water surface elevations (WSE) of the reservoirs and the flow of the rivers.

4.8.1 Environmental Setting/Affected Environment

Local Project Area

The 2006 American River Division Long Term Contract Renewal EIS, and the 2010 Folsom Lake State Recreation Area and Folsom Powerhouse State Historic Park General Plan/Resource Management Plan Final EIR/EIS Volumes I and II generally characterizes the local project area's recreation resources. This resource area updates and evaluates recreational resources on Folsom and Nimbus reservoirs and the lower American River.

Regional Effects Assessment Area

The Recreation discussion in Section 15 of the 2016 Coordinated Long Term Operation of the Central Valley Project and State Water Project EIS generally characterizes the regional project area's recreation resources and affected environment. Recreation is directly correlated to reservoir storage levels and river flow. CalSim II modeling presented in Section 4.2 and 4.6, and Appendix A, indicates reservoir storage and river flows are equal to or less than 1 percent over the entire model period. Short and long-term effects are considered negligible to no effect and do not rise to a level of significance requiring additional analysis and discussion. Therefore, the regional effects assessmentis not discussed further for recreation. See Appendix A for a discussion of CalSim II model results.

4.8.2 Environmental Consequences

Methodology

To evaluate reservoir operations and associated changes in Folsom Lake water surface elevations, CalSim II end-of-month storage data from baseline and with-project conditions will provide the input to the lake recreation effects evaluations. As such, this resource evaluation is relevant for and limited to the modeling assumptions incorporated into the CalSim II baseline and with-project conditions. To evaluate changes that may have an effect on lower American River recreation, monthly maximum flows will be evaluated using release data from period of record HEC-ResSim simulations as input into a lower American River HEC-RAS model.

The key variable for recreation in Folsom - primarily for purposes of access, inundation and aesthetics - is water surface elevation, a secondary variable derived from storage in the lake. Long-term monthly averages will be determined for lake elevations to complete the effects analysis on recreation resources. Because Nimbus is a regulating reservoir, water surface elevation fluctuates daily and is not considered a factor in evaluating its recreational use.

Surface water flows and water surface elevations, or stage, are similarly important in regard to evaluation of effects to recreation downstream of the major reservoirs. Because these parts of the riverine systems are generally not impounded, flow is the primary variable affecting stage and, therefore, is another key variable in the effects analysis for recreation. Table 4-44 summarizes the parameters to be use in the effects analysis.

Table 4-44. Recreation and Resources Parameters and Index Locations.

Model Parameter	Index Location
Reservoir Water Surface Elevations	Folsom
Flow	Lower American River at Nimbus Lower American River below H Street

Reductions in water surface elevations below known accessibility and safety thresholds will be evaluated to identify significant effects to recreation in the noted reservoirs. Although the threshold elevations and flows are known, as noted below, the quantitative definition of 'substantial change' has not been defined at this time.

Basis of Significance

To evaluate the significance of effects the Manual Update alternatives would have on water-dependent and water-enhanced recreation opportunities, metrics and criteria from the 1994 and 2004 Interim Agreements were used. The probability of exceedance at each threshold of significance was compared to a baseline condition.

The following criteria will be applied to evaluate effects to recreation caused by modification of flood risk reduction operations at Folsom Dam:

- A substantial change in lower American River flows above or below the 1,750 to 6,000 cfs minimum/maximum range for recreational activity;
- A substantial change in lower American River flows outside of the 3,000 – 6,000 cfs typically associated with suitable recreation conditions;
- A substantial increase in the frequency American River flows sufficient to cause flooding, park closures, and damage to park facilities as identified below:

Flows	Parkway Closures
20,000 cfs	Discovery Park, Woodlake Access; Howe Avenue River Access; Watt Avenue River Access
50,000 cfs	Harrington Access; Upper Sunrise Access; Gristmill Access; Olive Access; Arden Park
75,000 cfs	Sunrise Access; Sarah Court Access; Ancil Hoffman Park; El Manto Access; Riverbend Park; Sacramento Bar Access; Sailor Bar Access
100,000 cfs	Ambassador Access, Rossmoor Bar Access;
130,000 cfs	Arden Park
200,000 cfs	Hazel Access

- Conflict with American River Parkway Plan and Wild and Scenic Rivers Acts (see Section 6 for more information on compliance with these laws)
- A substantial increase in the frequency that Folsom Reservoir water surface elevation is below the following levels between May and September:

Folsom Lake Water Surface Elevation	Boating Access Limitations
435 feet	Below optimal reservoir access limit
425 feet	Extreme access limitation
412 feet	Boat removal from marina slips required
400 feet	5 mph boat speed limit imposed and recreation considered to be at approximately 25 percent capacity

- A substantial change in Folsom Reservoir elevation, when No Action/No Project water surface elevations are 435 feet or greater, that results in a post-project water surface elevation of less than 435 feet between May 15 and September 15.

No Action/No Project

Under the No Action Alternative, Folsom Lake and Dam would continue to operate under the existing Water Control Manual. The new auxiliary dam would not be utilized except in extremely rare circumstances that threaten the structural integrity of Folsom Dam. Release schedules for Folsom Dam would remain the same. Folsom Lake would continue to be required to reduce the water conservation pool to at least 400,000 af during the flood season. Water available for recreational purposes would be expected to remain relatively unchanged from existing conditions.

Alternative 2 – Forecast Informed Operations with Variable Folsom Flood Control Space (400,000 af to 600,000 af)

Local Project Area

Lower American River

Exceedance probability plots of lower American River flows below Nimbus Dam were generated from the simulated 82-year period of record hydrology for the No Action/No Project and Alternative 2 – Forecast-informed Operations ResSim models. Table 4-45 provides a summary of the model differences generated for the maximum, minimum, and minimum adequate flows on the river. Maximum and minimum optimal flows range from -2.1 to 2.4 percent. Because the modeling range falls within the 5 percent significance threshold established for CalSim II modeling in Section 4.1.7, basis of significance impacts are negligible to less than significant. However, there is a positive effect on the minimum adequate flow of 1,750 cfs, which has a probability of exceedance which ranges from 2.4 to 16.9 percent under Alternative 2. Therefore, minimum adequate flow is met more frequently under the Alternative 2 - Forecast-informed Operations than with No Action/No Project. Overall, the effects that Alternative 2 would have on recreational flows on the lower American River would be considered less than significant. In addition, the lower American River is designated as Recreational under the Wild and Scenic Rivers Act. Because the Folsom Manual Update has only potential positive impacts, the Update is consistent with the American River Parkway Plan and Wild and Scenic Rivers Acts. A detailed discussion of modeling results in presented in Appendix A.

Table 4-45. Lower American River Recreation Probability of Exceedance Threshold between Alternative 2 - Forecast-informed Operations and No Action/No Project for Recreational Flow Requirements.

Lower American River Thresholds of Significance Flows (cfs)	Maximum Optimal 6,000	Minimum Optimal 3,000	Minimum Adequate 1,750
May	0.8 percent	1.1 percent	16.9 percent
June	1.5 percent	1.5 percent	10.9 percent
July	0.4 percent	–2.1 percent	2.4 percent
August	*	0.9 percent	9.1 percent
September	*	2.4 percent	1.6 percent

*Note: * Threshold of significance is not crossed.*

As discussed in Section 4.2 Hydrology and Hydraulics, modeling results for a range of discharge frequencies were developed (see Table 4-4 and Figure 4-12). While there are slight increases (eg 10,000 to 20,000 cfs, 40,000 to 60,000 cfs, and 70,000 to 90,000 cfs) and decreases (eg. 90,000 to 115,000 cfs), overall only 1 percent of the flows in the 82-year period of record are greater than 20,000 cfs, and Alternative 2 deviates less than 0.6 percent of the time from No Action/No Project operations. Evaluated against the significance criteria for flow events versus park closures, the Alternative 2 and the No Action/No Project differ far less than 0.01 percent of the time. Therefore, the effects that Alternative 2 would have on the lower American River park closures would be negligible and not significant because parkway closure occurrences would be similar to existing conditions. A detailed discussion of modeling results in presented in Appendix A.

Folsom Reservoir

Folsom Reservoir elevations are associated with access to boat ramps and swimming locations. CalSim II and HEC-ResSim modeling indicates the 435 foot surface elevation is met or exceeded more frequently with Alternative 2 - Forecast-informed Operations than with No Action/No Project in every month except for June (Table 4-46). Overall, the results do not rise to a level of significance as they do not exceed the 5 percent threshold significance for modeling output. However, the slight positive trend in July and August could be interpreted as a beneficial effect of implementing Alternative 2. Therefore, there would be negligible to no effect on recreational boat ramps or swimming locations.

Table 4-46. Percent Increase in Exceedance Probability of Folsom Reservoir water surface elevations exceeding 435 feet (NGVD) Alternative 2 - Forecast-informed Operations vs No Action/No Project.

Months	Percent Increase in Exceedance Probability of Folsom Reservoir water surface elevations exceeding 435 feet Alternative 2 vs. No Action/No Project
May	0.0 percent
June	-0.6 percent
July	3.3 percent
August	3.5 percent
September	0.8 percent

Future Level of Demand

Similar to existing level of demand, Alternative 2's Future Level of Demand scenario would slightly increase or not change Maximum Optimal, Minimum Optimal, and Minimum Adequate flows in the Lower American River relative to No Action/No Project. The percent differences for each range from 0.0 to 3.1 percent, -0.2 to 5.5 percent, and -2.4 to 5.3 percent respectively. Overall, these differences do not exceed the 5 percent threshold of significance. Where the results are "positive" and in excess of 5 percent, these are beneficial recreation effects to Lower American River flows. Therefore, the effect to Lower American River recreational resources is negligible to beneficial effect. See Appendix H for detailed results and discussion.

Folsom Reservoir elevations under Future Level of Demand scenarios do not exceed the modeling 5 percent significance threshold. The 435 foot elevation is met or exceeded more often under Alternative 2. Results for May to September range from -4.8 to 1.1 percent. Therefore, the effect to Folsom Reservoir recreational resources are negligible to no effect. See Appendix H for detailed results and discussion.

Cumulative

The two cumulative projects in Table 4-2 have no operational effects and will not result in any change in recreational resources or activities.

4.8.3 Mitigation

No mitigation is proposed for less than significant effects to recreation.

4.9 Cultural Resources

"Cultural resources" is a broad term that can refer to districts, sites, buildings, structures, and objects. Typically the term is applied to those resources which are more than fifty years of age. These may include prehistoric and historical archaeological sites and districts; architectural examples such as buildings, bridges, and infrastructure; and resources of importance to Native Americans such as Traditional Cultural Properties and sacred sites.

The term prehistoric refers to the time before the local written record. In California, prehistoric sites and resources are associated with Native American use before the arrival of European explorers and settlers. Archaeological sites dating to the time when these initial Native American-European contacts occurred are referred to as protohistoric. Historical archaeological sites can be associated with Native Americans, Europeans, or any other ethnic group. These sites may include the ruins of historical structures and buildings.

4.9.1 Environmental Setting/Affected Environment

Local Project Area

The histories of Folsom and Sacramento represent themes prevalent in California history: mining, railroads, early farming and industrial agriculture, flooding and water management. A discussion of cultural resources along the American River is included in Appendix A, Attachment 1, Appendix 1E of the "American River Watershed, California, Long-Term Study Final Supplemental Plan Formulation Report/Environmental Impact Statement/Environmental Impact Report, Volume II" (USACE 2002) and the Historical Overview of Dames & Moore's 1995 report: "Archeological Inventory Report, Lower American River Locality." A more recent and geographically specific discussion of cultural resources around Folsom Dam is included in the 2007 FEIS/EIR (USBR 2007), as well as the "Cultural Resources Literature Search, Inventory, and National Register Evaluation for the Folsom Dam Safety and Flood Damage Reduction EIS/EIR" completed by Pacific Legacy, Inc. (Bartoy et al 2007). Prehistoric, ethnographic, and historical setting narratives are included in the above reports, and provide the basis for the following section. Numerous archaeological investigations have also covered large portions of the project area on the American River (e.g., Far Western, 1990; Dames & Moore, 1994; Waechter 1994).

Area of Potential Effects

USACE has identified an Area of Potential Effects (APE) that includes an upstream section comprising a portion of the reservoir pool and a downstream section that would potentially include parts of the 22 mile stretch of the Lower American River from Nimbus Dam to the confluence with the Sacramento River. Alternative 2 would result in fundamentally different kinds of effects in these two areas, based on the very different hydrologic conditions in each.

Records and Literature Search

Records and literature searches covering portions of the APE were conducted in 2006 and 2007, and updated in 2010, 2011, 2013, and 2017 at the North Central Information Center (NCIC) of the California Historical Resources Information System, located at California State University, Sacramento.

Regional Effects Assessment Area

The Cultural Resources discussion in Section 17 of the Coordinated Long Term Operation of the Central Valley Project and State Water Project EIS generally characterizes the regional project area's cultural resources, affected environment, and management for this resource.

4.9.2 Environmental Consequences

Methodology and Basis of Significance

The assessment of environmental consequences to cultural resources follows the process laid out in Section 106 of the National Historic Preservation Act of 1966, as amended (54 USC 306108) (NHPA Section 106). NHPA Section 106 requires Federal agencies to consider the effects of their undertakings on cultural resources that are eligible for inclusion in the National Register of Historic Places (NRHP). Such eligible resources are called "historic properties". Adverse effects to historic properties (per 36 CFR 800.5) are considered significant effects for the purposes of this document.

In order for a cultural resource to be considered a historic property, and thus eligible for the NRHP, it must typically be at least 50 years of age, and must meet at least one of the four criteria of significance and retain adequate integrity to express that significance. Resources less than 50 years old may be considered if they are of exceptional significance. Generally, districts, sites, buildings, structures, and objects are considered historic properties if they possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

- Are associated with events that have made a significant contribution to the broad patterns of our history; or
- Are associated with the lives of significant persons in our past; or
- Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- Have yielded or may be likely to yield, information important in history or prehistory.

In order to consider the effects of an undertaking on historic properties, the implementing regulations at 36 CFR 800 guide Federal agencies through a four step process. These steps are: initiate the Section 106 process, identify historic properties, assess adverse effects, and resolve adverse effects. The Corps has decided to comply with NHPA Section 106, and complete these steps, through the execution and implementation of a Programmatic Agreement (PA), following 36 CFR 800.14(b). BOR will be implementing the WCM update, and is a signatory to the PA; BOR has agreed that the Corps will be the Lead Federal Agency for the purposes of NHPA Section 106 compliance. The Advisory Council on Historic Preservation has also opted to be a signatory to the PA. The Central Valley Flood Protection Board is the non-Federal sponsor for the WCM update and has been invited to be a concurring party to the PA

Federally recognized and non-Federally recognized Native American tribes have also been invited to be involved in the composition of the PA and execution of NHPA Section 106 compliance activities. The Corps has initiated consultation with the following Federally recognized tribes: the Buena Vista Rancheria of the Me-Wuk Indians of California, the Cachil DeHe Band of Wintun Indians of the Colusa Indian Community of the Colusa Rancheria, the Cortina Wintun Environmental Protection Agency, the Enterprise Rancheria of Maidu Indians of California, the Ione Band of Miwok Indians of California, the Mechoopda Indian Tribe of Chico Rancheria, the Mooretown Rancheria of Maidu Indians, the Shingle Springs Band of Miwok Indians, the United Auburn Indian Community of the Auburn Rancheria (UAIC), the Wilton Rancheria, and the Yocha Dehe Wintun Nation. The Corps has initiated consultation with the following non-Federally recognized tribes: the Colfax-Todds Valley Consolidated Tribe, the El Dorado Miwok Tribe, the Nashville-El Dorado Miwok, the Strawberry Valley Rancheria, the T'si-Akim Maidu, and interested Native American individuals. As of July 2017, UAIC is the only Federally recognized tribe that has indicated a desire to participate; the Corps has invited them to sign the PA as a concurring party.

The Corps will focus on the analysis of effects to previously documented cultural resources by compiling and implementing a Site Condition Assessment and Monitoring Plan (SCA&MP), in consultation with all parties. All cultural resources will be treated as potential historic properties prior to fieldwork and any assessment of eligibility for the NRHP. The SCA&MP document will allow for the complete consideration of effects of the WCM update undertaking by reviewing previously recorded cultural resources in the APE, and providing for a program of monitoring the condition of selected sites over time. Fieldwork to determine the baseline site conditions was scheduled to be performed when the SCA&MP is finished, or whenever reservoir levels are low enough to permit access to the APE after the execution of the PA. Due to fortuitously low water, USACE archaeologists performed field visits throughout 2017 and 2018. Any new sites encountered as a result of fieldwork will also be included and assessed per the process outlined in the SCA&MP. The SCA&MP document will be completed no later than 12 months after the execution of the PA.

A site condition assessment report will be prepared within 60 days of fieldwork completion. It will contain descriptions of each site visited and identify which sites may require future monitoring. Specific methods guiding site condition assessments, including NRHP eligibility, effects on potential historic properties, and expected deliverables will be outlined in the SCA&MP. After monitoring, a technical report presenting the results of implementing the SCA&MP will be assembled 5 years following the execution of the PA; the Corps will submit the technical report for review to all consulting parties. The Corps will also prepare an article for publication in a peer-reviewed journal that discusses the process used to assess the effect of the WCM update on cultural resources. Any adverse effects that may be identified will be resolved through the implementation of the SCA&MP, including the preparation of the technical report and journal article. These documents will potentially provide important new information on the effects of impounded artificial reservoirs on cultural resources located at or within the fluctuation zone.

California Environmental Quality Act

CEQA provides a broad definition of what constitutes a cultural or historical resource. Cultural resources can include traces of prehistoric habitation and activities, historic-era sites and materials, and places used for traditional Native American observances or places with special cultural significance. In general, any trace of human activity more than 50 years in age must be treated as a potential cultural resource.

CEQA states that if a project would have potentially significant or significant impacts on important cultural resources, then alternative plans or mitigation measures must be considered. However, only significant cultural resources (termed "historical resources") need to be addressed. The State CEQA Guidelines define a historical resource as a resource listed or eligible for listing in the California Register of Historical Resources (CRHR) (California PRC Section 5024.1). The State CEQA Guidelines also require consideration of unique archaeological resources (Section 15064.5). As used in PRC Section 21083.2, the term "unique archaeological resource," means an archaeological artifact, object, or site about which it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it meets one or more of the following criteria:

(1) Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information.

(2) Has a special and particular quality such as being the oldest of its type or the best available example of its type.

(3) Is directly associated with a scientifically recognized important prehistoric or historic event or person.

Assembly Bill 52

In September of 2014, the California Legislature passed Assembly Bill (AB) 52, which addedprovisions to the Public Resources Code regarding the evaluation of impacts on tribal cultural resources under CEQA, and consultation requirements with California Native American tribes. In particular, AB 52 now requires lead agencies to analyze project impacts on "tribal cultural resources," separately from archaeological resources (PRC § 21074; 21083.09). The Bill defines "tribal cultural resources" in a new section of the PRC Section 21074. AB 52 also requires lead agencies to engage in additional consultation procedures with respect to California Native American tribes (PRC § 21080.3.1, 21080.3.2, 21082.3). Finally, AB 52 requires the Office of Planning and Research to update Appendix G of the CEQA Guidelines by July 1, 2016 to provide sample questions regarding impacts to tribal cultural resources (PRC § 21083.09). Coordination and consultation conducted with California Native American tribes is documented in Appendix F.

The provisions of AB 52 only apply to projects that have a NOP filed on or after July 1, 2015, and therefore the Bill's requirements are not applicable to the proposed project (the NOP was filed October 12, 2012 SCH# 2012102034). Although AB 52 requirements were not in place at the time of the NOP, Tribal coordination noted above and documented in Appendix F, occurred and is substantially consistent with the intent of AB52 for this project.

No Action/No Project

Under No Action/No Project, Folsom Dam would continue to operate under the existing plan. This would allow existing processes of erosion and wet-dry cycles within the reservoir to continue and the current release of potentially erosive flows from the dam would also carry on. Historic properties that exist within the reservoir and downstream would continue to be slowly degraded over time.

Alternative 2 – Forecast Informed Operations with Variable Folsom Flood Control Space (400,000 af to 600,000 af)

In the reservoir pool, potential effects to historic properties and potential historic properties would accrue largely as a result of lake level fluctuation. Lake level fluctuation can erode the shoreline and potentially historic properties with it, and frequent wetting and drying cycles could also be damaging to a wide range of materials that exist in archaeological sites and other cultural resources. Since the WCM would directly affect the operation of the lake, and therefore the lake levels, determining the reservoir pool portion of the APE was a matter of identifying where the frequency of wetting/drying cycles would be increased relative to the existing operation of the lake.

USACE engineers modeled the frequency of wet/dry cycles for the existing operation of Folsom Dam and a hypothetical operation conducted under the WCM. In both cases, one wet/dry cycle is defined as a single instance where a given water surface elevation becomes inundated, then dries for at least one week. The model is based on an 80 year record of flows into Folsom Lake. These analyses suggest that the WCM operation would result in generally more stable lake levels, which would decrease the rate of site decay through most of the reservoir drawdown zone. However, at elevations between 426 feet and 430 feet, the model predicts more than 10 wet/dry events over the 80 year period of analysis.

Identifying the downstream portion of the APE was based on the locations where USACE modeling suggests the potential for river bank (i.e. channel widening) erosion would be increased under Alternative 2. Within the downstream portion, sediment transport is understood to begin around 30,000 cfs and therefore this is also the flow above which bank erosion is possible. Alternative 2 would increase the frequency of flows between 40,000 cfs and 90,000 cfs, so it is reasonable to expect an increase in erosion. However, the course of the American river downstream of Nimbus dam is not equally susceptible to this increased erosion. USACE analyses suggests that the highest risk of channel widening erosion exists in unarmored portions of subreach 8. Some channel widening may also occur in subreaches 1-4 and 7, but less than would be expected in subreach 8. In addition, the critical discharge for bank erosion was estimated to compute the number of additional erosive flows relative to existing operation of Folsom Dam based on the same 80 year record of flows. This analysis is consistent with the findings of the erosion analysis but also indicates that portions of subreaches 5, 6, and 9 may experience additional erosion relative to existing operation of Folsom Dam. The downstream portion of the APE therefore conservatively includes all subreaches of the Lower American River except for subreach 10.

Effects to historic properties may be considered potentially significant under CEQA. As explained in Section (4.1.8.), a potentially significant impact is one that if it were to occur, would be considered to be a significant impact. However, since the occurrence of the impact cannot be immediately determined with certainty, a potentially significant impact is treated as if it were a significant impact. Based on historic records, archaeological surveys, and literature searches there may be potential historic properties within the APE around Folsom Reservoir and along the lower American River. Since impacts are unknown, it is unclear if mitigation measures will reduce impacts to less than significant. Therefore, for CEQA purposes, impacts to cultural resources remain potentially significant.

4.9.3 Mitigation

As described above, adverse effects will be mitigated through the process outlined in the PA.

5.0 OTHER ENVIRONMENTAL REQUIREMENTS

5.1 Growth-Inducing Effects

NEPA and CEQA both require a discussion on how a project, if implemented, could induce growth. This section presents an analysis of the potential growth-inducing effects of the proposed project. Direct growth inducement would result if a project involved construction of new housing. Indirect growth inducement would result, for instance, if implementing a project results in any of the following:

- Substantial new permanent employment opportunities (e.g., commercial, industrial, or governmental enterprises);
- Substantial short-term employment opportunities (e.g., construction employments) that indirectly stimulates the need for additional housing and services to support the new, temporary employment demand; and/or
- Removal of an obstacle to additional growth and development, such as removing a constraint on a required public utility or service (e.g., construction of a major sewer line with excess capacity through an undeveloped area.

Growth inducement may lead to environmental effects, such as increased demand for utilities and public services, increased traffic and noise, degradation of air or water quality, degradation or loss of plant or animal habitats, and conversion of agricultural and open space land to urban uses. Growth within a floodplain area increases the risk to people or property from flooding.

Within the study area, growth and development are controlled by the local governments of the City of Folsom, and Sacramento, El Dorado, and Placer Counties. Consistent with California law, each of these local governments has adopted a general plan and each general plan provides an overall framework for growth and development within the jurisdiction of each local government. Local, regional, and national economic conditions also directly affect growth and development.

The alternatives currently being considered for the Manual Update would not contribute directly to population or economic growth as no additional housing or businesses would be built. However, the overall JFP would generate additional economic benefits during construction and would contribute to greater flood risk management for the Sacramento area once complete. The potential for any growth-inducing effects associated with the overall JFP were analyzed under the 2007 FEIS/EIR (USBR 2007).

The Manual Update itself would not promote or contribute to any regional economic or population growth. Any future local growth would be consistent with the local general plans, as described above.

5.2 Unavoidable Significant Effects

The CEQ's NEPA Compliance Guide and State CEQA Guidelines both state that any significant adverse environmental effects which cannot be avoided if the project is implemented must be described. This description includes significant adverse effects which can be mitigated, but not reduced to a level of insignificance. Chapter 4 provides a detailed analysis of all potentially significant environmental impacts of the Manual Update, feasible mitigation measures that could reduce or avoid the project's impacts, and whether these mitigation measures would reduce these impacts to less than significant levels. If a specific impact cannot be reduced to less than significant level, it is considered a significant and unavoidable impact. The Manual Update has the potential to result in unavoidable and significant effects to cultural resources under CEQA. However, it is not expected to result in any unavoidable significant effects under NEPA.

5.3 Relationship between Short-Term Uses of the Environment and Maintenance and Enhancement of Long-Term Productivity

In accordance with NEPA, this section discusses the relationship between local short-term uses of the human environment and maintenance of long-term productivity for the project. The long-term productivity of the environment would be increased by improving public safety due to stronger flood control measures and reducing flood damage.

5.4 Irreversible and Irretrievable Commitment of Resources

NEPA and CEQA Guidelines require a discussion of the significant irreversible environmental changes that would be caused by the project should it be implemented.

The irreversible and irretrievable commitments of resources are a permanent loss of the resources for future or alternative purposes. Irreversible and irretrievable resources are those that cannot be recovered or recycled, or those that are consumed or reduced to unrecoverable forms. Project implementation would result in the irreversible and irretrievable commitments of energy and material resource during implementation and operation, including the following:

- Land and water area committed to the new variable storage space; and
- Energy expanded in the form of electricity, gasoline, diesel fuel and oil for equipment and transportation vehicles In accordance with NEPA, this EA discusses any irreversible and irretrievable commitment of resources that would be required for project operation and maintenance.

The use of these nonrenewable resources is expected to account for only a small portion of the region's resources and would not affect the availability of these resources for other needs within the region.

As described throughout this SEA/EIR, without implementation of the updated WCM, the reduction of flood risk benefits would remain. While a precise quantification of impacts associated with flood risk reduction is not possible, there is a potential for a variety of impacts. Flooding and the resulting emergency and reconstruction efforts could expend more energy, overall, than with implementation of forecast based water releases. A large volume of debris would result from a flood event; such things as cars, appliances, housing materials, and vegetation would all be generated during a flood event and would likely have to be disposed of in a landfill. After debris removal is completed, re-building would occur and new materials would be required to repair and/or construct homes, businesses, roads, and other urban infrastructure. Thus, project implementation preempts potentially substantial future consumption and is likely to result in long-term energy and materials conservation.

5.5 Fish and Wildlife Coordination Act Recommendations

The USFWS provided a final Fish and Wildlife Coordination Act Report (CAR) for the Folsom WCM in November 2017.

The CAR concluded that with operations under the manual update, some additional erosion and gravel movement may occur due to slightly more frequent, moderately high peak outflows of 40k-80k cfs. However, for the much larger but rarest events, the proposed operation would limit outflows, reducing the potential for catastrophic damage that could result from uncontrolled outflows and/or levee failure. The damage to resources avoided by the updated manual operations would be in the form of extensive erosion of berm areas along the river, as well as localized incision of the gravel bed. Overall, the risk of very large flows (>160k cfs) which would severely impact resources is greatly reduced, the frequency of moderate flows believed to have modest benefits to resources (40k-60k cfs) is slightly increased. Additionally, the CAR concluded that consequences of the proposed update for fisheries resources due to downstream effects in the Sacramento-San Joaquin Delta would be infrequent and of a low magnitude. Considering all such effects, both in the lower American River on flow spectrum, storage, and related factors such as temperature and erosion, and elsewhere, the CAR concluded that the net, long term effects on riparian and fisheries resources of operations under the proposed manual update would be beneficial.

The CAR also recommended USACE and local sponsor implement a limited monitoring program sufficient to detect possible effects of operation under the WCM update on river bank/berm and gravel bed stability, and related factors such as SRA cover, percent fines, and vegetation encroachment onto bar surfaces. Additionally, the CAR recommended USACE consider contingency actions in case monitoring shows that habitat has been adversely affected by operations due to the manual update. Recommended actions include proactive structural measures to improve gravel retention or biotechnical bank stabilization in areas at risk from moderate flow increases, and reactive measures such as spawning gravel enhancement in areas of loss or extended monitoring.

Implementation of these recommendations is currently under consideration and will be utilized to the extent possible.

The final CAR is included in Appendix J.

5.6 Identification of Environmentally Preferred and Environmentally Superior Alternative

NEPA requires that the environmentally preferable alternative be identified. This is defined as the alternative that will promote the national environmental policy as expressed in Section 101 of NEPA, meaning the alternative that causes the least damage to the biological and physical environment. In addition, it also means the alternative that best protects, preserves and enhances historic, cultural and natural resources. Although NEPA regulations require the identification of the environmentally preferred alternative, it is not required that this alternative be adopted. In addition, if the No Action Alternative is identified as the environmentally superior alternative, the EA must also identify the environmentally superior with-project alternative. Under CEQA, the goal of identifying the environmentally superior alternative is to assist decision makers in considering project approval. Likewise, CEQA does not require an agency to select the environmentally superior alternative.

Alternative 2 would have the lowest level of developmental impacts and would ensure future protection of biological and cultural resources. Using forecast-based releases would minimize the potential effects to biological resources, public services, utilities, water quality, and cultural resources compared to the other alternatives. It would provide more flexibility with releases and allow for more conservative water storage and releases. Additionally, use of the auxiliary dam and variable space would reduce the flood risk to the local and regional effects assessment area and reduce the chance of emergency releases which could cause extensive damage to the human environment.

6.0 COMPLIANCE WITH APPLICABLE LAWS AND EXECUTIVE ORDERS

6.1 Federal Laws and Executive Orders

6.1.1 National Environmental Policy Act of 1969

Full Compliance upon Signature of the FONSI

NEPA (42 USC 4321; 40 CFR 1500.1) applies to all Federal agencies and most of the activities they manage, regulate, or fund that have the potential to affect the environment. It requires all agencies to disclose and consider the environmental implications of their proposed actions. NEPA establishes environmental policies, provides an interdisciplinary framework for preventing environmental damage, and "action-forcing" procedures to ensure that Federal agency decision-makers take environmental factors into account.

NEPA requires the preparation of an appropriate document to ensure that Federal agencies accomplish the law's purposes. The President's Council on Environmental Quality (CEQ) has adopted regulations and other guidance, including detailed procedures that Federal agencies must follow, to implement NEPA.

Upon signature of the FONSI by the USACE Commander, South Pacific Division, full compliance with NEPA will be met.

6.1.2 National Historic Preservation Act of 1966

Full Compliance

Section 106 of the National Historic Preservation Act (NHPA) requires Federal agencies to take into account the effects of a proposed undertaking on properties that have been determined to be eligible for, or included in, the National Register of Historic Places (NRHP). If cultural resource(s) have been identified during a survey or record and literature search, the Federal agency overseeing the project begins the process to determine whether the cultural resources is/are eligible for listing in the NRHP. Section 106 of the NHPA as amended, mandates the evaluation process. The implementing regulations for Section 106 are at 36 C.F.R. § 800 et seq.

Inventory, evaluation for listing in the NRHP, and determinations of effects to cultural resources are made by Federal agencies for cultural resources within a project's APE. For purposes of complying with Section 106 of the NHPA, a Federal agency will make a determination of the APE for the project or undertaking. The APE is defined as "the geographic areas or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist." Additionally, the APE "is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking."

The APE for an undertaking may extend beyond the physical impacts associated with a project. Depending on the scale and nature of the undertaking and the known and anticipated types of cultural resources, the direct or indirect effects may include physical modification, intrusion to the visual or esthetic characteristics of landscapes or features, or even access to a historic property.

For a Federal project to be in compliance with Section 106, one of the following five scenarios will occur: (1) no historic properties exist in the APE; (2) the undertaking does not have the potential to affect historic properties; (3) there are known historic properties in the APE but the undertaking will not adversely affect them; (4) known historic properties will be adversely affected by the project and a memorandum of agreement (MOA) or programmatic agreement (PA) may be executed that will guide the mitigation or resolution of adverse effects; or (5) adverse effects are not known and a PA may be executed that will guide the inventory and identification of historic properties, evaluation of potential adverse effects to historic properties, and mitigation or resolution of adverse effects.

MOAs and PAs are negotiated between the Federal agency, the State Historic Preservation Officer (SHPO), and possibly the Advisory Council on Historic Preservation. Other entities such as the local sponsor, historic preservation groups, and Native American tribes may be invited to participate as concurring parties to MOAs and PAs.

For this undertaking, a PA was executed in February 2018, to manage the inventory and evaluation of cultural resources and mitigation of adverse effects to historic properties. A record of the consultation for this project as it relates to compliance with Section 106 is included in Appendix F.

6.1.3 Clean Air Act

Full Compliance

The Federal Clean Air Act (CAA) established national ambient air quality standards (NAAQS) in 1970 for six pollutants: carbon monoxide, ozone, particulate matter, nitrogen dioxide, sulfur dioxide, and lead.

The conformity provisions of the CAA are designed to ensure that Federal agencies contribute to efforts to achieve the NAAQS. USEPA has issued two regulations implementing these provisions. The general conformity regulation addresses actions of Federal agencies other than the Federal Highway Administration and the Federal Transit Administration. General conformity applies to a wide range of actions or approvals by Federal agencies. Projects are subject to general conformity if they exceed emissions thresholds set in the rule and are not specifically exempted by the regulation. Such projects are required to fully offset or mitigate the emissions caused by the action, including both direct emissions and indirect emissions over which the Federal agency has some control.

Due to the nature of this project, no impacts to air quality are expected to occur.

6.1.4 Rivers and Harbors Act

Full Compliance

Section 10 of the Rivers and Harbors Act of 1899 regulates alteration of (and prohibits unauthorized obstruction of) any navigable waters of the United States. Construction of any bridge, dam, dike or causeway over or in navigable waterways of the U.S. is prohibited without Congressional approval. Construction plans for a bridge or causeway must be submitted to and approved by the Secretary of Transportation, while construction plans for a dam or dike must be submitted to and approved by the Chief of Engineers and Secretary of the Army. Excavation or fill within navigable waters requires the approval of the Chief of Engineers and the Secretary of the Army.

There is no construction or alterations of the waterway associated with this project. Since this project only addresses changes to the way in which water is determined to be stored or released, the project is in compliance with the Rivers and Harbors Act.

6.1.5 Endangered Species Act

Full Compliance

The Endangered Species Act (ESA) requires that both USFWS and NMFS maintain lists of threatened and endangered species. “Endangered species” are defined as “any species which is in danger of extinction throughout all or a significant portion of its range”; “threatened species” are defined as “any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range” (16 U.S.C.A. §1532). Section 9 of the ESA makes it illegal to “take” (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in such conduct) any endangered species of fish or wildlife and most threatened species of fish or wildlife (16 U.S.C.A. §1538). Section 7 of the ESA requires that Federal agencies consult with the USFWS and NMFS on any actions that may directly or indirectly affect a listed species (i.e., a species specifically recognized by USFWS or NMFS as being endangered or threatened), including as related to whether the action may destroy or adversely modify critical habitat. Critical habitat is defined as the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of Section 4 of the ESA, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of Section 4 of the Act, upon a determination by the Secretary that such areas are essential for the conservation of the species (16 U.S.C.A. §1532). NMFS’ jurisdiction under the ESA is limited to the protection of marine mammals and fishes and anadromous fishes (i.e., fish born in fresh water that migrate to the ocean to grow into adults and then return to fresh water to spawn); all other species are within the USFWS’ jurisdiction.

Section 7 of the ESA requires that all Federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of habitat critical to such species' survival. To ensure against jeopardy, each Federal agency must consult with the USFWS or NMFS, or both, regarding Federal agency actions. The consultation is initiated when the Federal agency determines that its action may affect a listed species and submits a written request for initiation to the USFWS or NMFS, along with the agency's biological assessment of its proposed action. If the USFWS or NMFS concurs with the action agency that the action is not likely to adversely affect a listed species, the action may be carried forward without further review under the ESA. Otherwise, the USFWS or NMFS, or both, must prepare a written biological opinion describing how the agency action will affect the listed species and its critical habitat.

USACE provided biological assessments to USFWS and NMFS and received biological opinions from both agencies in October, 2018. The biological opinions are included in Appendix K.

6.1.6 Fish and Wildlife Coordination Act

Full Compliance

The FWCA (16 USC 661 et seq.) requires Federal agencies to consult with USFWS before undertaking or approving water projects that control or modify surface water. The purpose of this consultation is to ensure that wildlife concerns receive equal consideration during water resource development projects and are coordinated with the features of these projects. The consultation is intended to promote the conservation of fish and wildlife resources by preventing their loss or damage and to provide for the development and improvement of fish and wildlife resources in connection with water projects. Federal agencies undertaking water projects are required to fully consider recommendations made by USFWS, NMFS, and State fish and wildlife resource agencies in project reports and to include measures to reduce impacts on fish and wildlife in project plans.

USACE consulted with USFWS and NMFS during the development of the WCM. USFWS prepared a final Coordination Act Report in November 2017 (Appendix J).

6.1.7 Indian Sacred Sites

Full Compliance

Executive Order 13007 (May 24, 1996) requires that Federal agencies accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners, and avoids adversely affecting the physical integrity of such sacred sites. The Proposed Action would establish new flood risk management and dam safety operations criteria for Folsom Dam and Lake with the JFP in place. The proposed changes would not affect access to or use of Indian sacred sites.

6.1.8 Indian Trust Assets

Full Compliance

Indian Trust Assets are legal interests in assets that are held in trust by the United States for federally recognized Indian tribes or individuals. There are no Indian reservations, rancherias or allotments in the project area. The closest Indian Trust Asset to the proposed project area is the United Auburn Indian Community Rancheria which is located 14.17 miles to the north (Appendix F). The Proposed Action will have no impacts to ITAs.

6.1.9 Magnuson-Stevens Fishery Conservation and Management Act

Full Compliance

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) establishes a management system for national marine and estuarine fishery resources. This legislation requires that all Federal agencies consult with NMFS regarding all actions or proposed actions permitted, funded, or undertaken that may adversely affect "essential fish habitat." Essential fish habitat is defined as "waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The legislation states that migratory routes to and from anadromous fish spawning grounds are considered essential fish habitat. The phrase "adversely affect" refers to the creation of any impact that reduces the quality or quantity of essential fish habitat. Federal activities that occur outside of an essential fish habitat but that may, nonetheless, have an impact on essential fish habitat waters and substrate must also be considered in the consultation process. Under the Magnuson-Stevens Act, effects on habitat managed under the Pacific Salmon Fishery Management Plan must also be considered.

The Magnuson-Stevens Act states that consultation regarding essential fish habitat should be consolidated, where appropriate, with the interagency consultation, coordination, and environmental review procedures required by other Federal statutes, such as NEPA, the Fish and Wildlife Coordination Act (FWCA), the Clean Water Act, and the ESA. Essential fish habitat consultation requirements can be satisfied through concurrent environmental compliance if the lead agency provides NMFS with timely notification of actions that may adversely affect essential fish habitat and if the notification meets requirements for essential fish habitat assessments.

USACE received a biological opinion from NMFS in October, 2018 (Appendix K). NMFS recommended gravel augmentation for EFH conservation and establishment of or contribution to an existing spawning gravel monitoring program. The recommended gravel augmentation and monitoring will be implemented annually by SAFCA.

6.1.10 Migratory Bird Treaty Act

Full Compliance.

The Migratory Bird Treaty Act of 1918 (MBTA) is the domestic law that implements four international treaties and conventions between the U.S. and Canada, Japan, Mexico, and Russia, providing protection of migratory birds. Each of the conventions protects selected species of migratory birds that are common to both the U.S. and one or more of the other involved countries. This act makes it unlawful for any person to hunt, kill, capture, collect, possess, buy, sell, purchase, import, export, or barter any migratory bird, including the feathers, parts, nests, eggs, or migratory bird products. The MBTA does not protect the habitat of migratory birds. The Manual Update would not adversely affect migratory birds.

6.1.11 National Wild and Scenic Rivers Act

Full Compliance.

The National Wild and Scenic Rivers Act (P.L. 90-542; 16 USC 1271-1287) was established to preserve the free flowing condition and outstanding values of the nation's rivers. Rivers with unique scenery, recreational opportunities, cultural features, or other similar values are designated under this Act. Section 7 of the Act prohibits Federal licensing of new hydroelectric developments on all rivers designated under the Act. It also prohibits Federal funding or construction of projects that would inhibit the free flowing condition and outstanding values of designated rivers. The Act requires Federal agencies to manage each river in a way that protects and enhances the values for which the river was originally designated. The management of each river is based on the level of development at the time of designation. The lower American River, from the Nimbus Dam to the confluence with the Sacramento River, is protected under the Act and designated as Recreational.

The Manual Update is not expected to have an adverse effect on recreation, however, the National Parks Service, working under the Department of the Interior, has the jurisdiction for determination of whether any violations of this Act occur.

6.1.12 Executive Order, 11988, Floodplain Management, May 24, 1977

Full Compliance

The objective of this Executive Order is the avoidance, to the extent possible, of long- and short-term adverse effects associated with the occupancy and modification of the base flood plain (1 percent annual event) and the avoidance of direct and indirect support of development in the base flood plain wherever there is a practicable alternative.

While the Manual Update would reduce the frequency of 1 percent annual chance event flows into the lower American River, an existing levee system is already in place that protects the highly developed portions of the Sacramento Metropolitan area that would otherwise be in the base flood plain. The Manual Update would further reduce the risk of flooding to the already-developed areas downstream of Folsom Dam.

6.1.13 Executive Order 11990, Protection of Wetlands, May 24, 1977

Full Compliance

This executive order directs Federal agencies, in carrying out their responsibilities, to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands.

With respect to the Manual Update, since there is no construction or physical alteration to the landscape occurring, the project would not adversely affect wetlands.

6.1.14 Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, February 11, 1994

Full Compliance

Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority and Low-Income Populations,” requires that Federal agencies identify and address any disproportionately high and adverse human health or environmental effects of Federal actions on minority and low-income populations and assure that Federal actions do not result directly or indirectly in discrimination on the basis of race, color, national origin, or income. Federal agencies must provide opportunities for input by affected communities into the NEPA process and must evaluate the potentially significant and adverse environmental effects of proposed actions on minority and low-income communities during environmental document preparation. Even if a proposed Federal project would not result in significant adverse impacts on minority and low-income populations, the environmental document must describe how the NEPA process addressed Executive Order 12898.

With respect to the Manual Update, since there is no construction or physical alteration occurring, the project would not affect low income populations within the project area.

6.1.15 Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, November 6, 2000.

Full Compliance

Fundamental Principles. In formulating or implementing policies that have tribal implications, agencies shall be guided by the following fundamental principles:

(a) The U.S. has a unique legal relationship with Indian tribal governments as set forth in the Constitution of the U.S., treaties, statutes, Executive Orders, and court decisions. Since the formation of the Union, the U.S. has recognized Indian tribes as domestic dependent nations under its protection. The Federal Government has enacted numerous statutes and promulgated numerous regulations that establish and define a trust relationship with Indian tribes.

(b) Our Nation, under the law of the U.S., in accordance with treaties, statutes, Executive Orders, and judicial decisions, has recognized the right of Indian tribes to self-government. As domestic dependent nations, Indian tribes exercise inherent sovereign powers over their members and territory. The U.S. continues to work with Indian tribes on a government-to-government basis to address issues concerning Indian tribal self-government, tribal trust resources, and Indian tribal treaty and other rights.

(c) The U.S. recognizes the right of Indian tribes to self-government and supports tribal sovereignty and self-determination.

USACE will continue to coordinate with tribal governments in the project area.

6.1.16 Executive Order 13751, Safeguarding the Native from the Impacts of Invasive Species, December 5, 2006 (amendment to Executive Order 13112)

Full Compliance

Executive Order 13112 of February 3, 1999 (Invasive Species), called upon executive departments and agencies to take steps to prevent the introduction and spread of invasive species, and to support efforts to eradicate and control invasive species that are established. Executive Order 13112 also created a coordinating body -- the Invasive Species Council, also referred to as the National Invasive Species Council -- to oversee implementation of the order, encourage proactive planning and action, develop recommendations for international cooperation, and take other steps to improve the Federal response to invasive species. Past efforts at preventing, eradicating, and controlling invasive species demonstrated that collaboration across Federal, State, local, tribal, and territorial government; stakeholders; and the private sector is critical to minimizing the spread of invasive species and that coordinated action is necessary to protect the assets and security of the United States.

This order amends Executive Order 13112 and directs actions to continue coordinated Federal prevention and control efforts related to invasive species. This order maintains the National Invasive Species Council (Council) and the Invasive Species Advisory Committee; expands the membership of the Council; clarifies the operations of the Council; incorporates considerations of human and environmental health, climate change, technological innovation, and other emerging priorities into Federal efforts to address invasive species; and strengthens coordinated, cost-efficient Federal action.

6.2 State Laws

6.2.1 California Environmental Quality Act

Full Compliance upon Acceptance of Notice of Determination

CEQA (Public Resource Code 21000 et seq.) is regarded as the foundation of environmental law and policy in California. CEQA's primary objectives are to:

- Disclose to decision-makers and the public the significant environmental impacts of proposed activities;
- Identify ways to avoid or reduce environmental damage;
- Prevent environmental damage by requiring implementation of feasible alternatives or mitigation measures;
- Disclose to the public the reasons for agency approval of projects with significant environmental impacts;
- Foster interagency coordination in the review of projects; and
- Enhance public participation in the planning process.

CEQA applies to all discretionary activities that are proposed or approved by California public agencies, including State, regional, county, and local agencies, unless an exemption applies. CEQA requires that public agencies comply with both procedural and substantive requirements. Procedural requirements include the preparation of the appropriate environmental documents, mitigation measures, alternatives, mitigation monitoring, findings, statements of overriding considerations, public notices, scoping, responses to comments, legal enforcement procedures, citizen access to the courts, notice of preparation, agency consultation, and State Clearinghouse review.

CEQA's substantive provisions require that agencies address environmental impacts, disclosed in an appropriate document. When avoiding or minimizing environmental damage is not feasible, CEQA requires that agencies prepare a written statement of the overriding considerations that resulted in approval of a project that will cause one or more significant effects on the environment. CEQA establishes a series of action-forcing procedures to ensure that agencies accomplish the purposes of the law. In addition, under the direction of CEQA, the California Resources Agency has adopted regulations, known as the State CEQA Guidelines, which provide detailed procedures that agencies must follow to implement the law.

This document serves as compliance for both NEPA and CEQA.

6.2.2 Porter-Cologne Water Quality Control Act

Full Compliance

The Porter-Cologne Water Quality Control Act (Porter-Cologne Act) established the California State Water Resources Control Board (SWRCB) and nine regional water quality control boards

(RWQCBs) as the primary State agencies with regulatory authority over California water quality and appropriative surface water rights allocations. The SWRCB administers the Porter-Cologne Act, which provides the authority to establish Water Quality Control Plans (WQCPs) that are reviewed and revised periodically. The Porter-Cologne Act also provides the SWRCB with authority to establish statewide plans.

The nine RWQCBs carry out SWRCB policies and procedures throughout the State. The SWRCB and the RWQCBs also carry out sections of the Federal CWA-administered by USEPA, including the NPDES permitting process for point source discharges and the CWA Section 303 water quality standards program.

WQCPs, also known as basin plans, designate beneficial uses for specific surface water and groundwater resources and establish water quality objectives to protect those uses. These plans can be developed at the SWRCB or the RWQCB level. RWQCBs issue waste discharge requirements for the major point-source waste dischargers, such as municipal wastewater treatment plants and industrial facilities. In acting on water rights applications, the SWRCB may establish terms and conditions in a permit to carry out WQCPs.

Effects to water quality are discussed in detail in Chapter 4 for both the local and regional project area. The proposed project would not substantially degrade water quality or violate local water quality standards or waste discharge requirements. The project would provide more flexibility in managing conservation storage to meet regional water quality requirements in the Delta.

6.2.3 California Endangered Species Act

Full Compliance

The California Endangered Species Act (CESA) (Fish and Game Code Sections 2050 to 2097) is similar to the ESA but pertains to only State-listed endangered and threatened species. CESA requires agencies to consult with CDFW when preparing documents under CEQA to ensure that actions of the State lead agency do not jeopardize the continued existence of listed species. CESA allows CDFW to identify “reasonable and prudent alternatives” to the project consistent with conserving the species. Agencies can approve a project that affects a listed species if the agency determines that there are “overriding considerations;” however, the agencies are prohibited from approving projects that would cause the extinction of a listed species.

Mitigating impacts on State-listed species involves avoidance, minimization, and compensation (listed in order of preference). Unavoidable impacts on State-listed species are typically addressed in a detailed mitigation plan prepared in accordance with CDFW guidelines. CDFW exercises authority over mitigation projects involving State-listed species, including those resulting from CEQA mitigation requirements.

CESA prohibits the “take” of plant and wildlife species State-listed as endangered or threatened. CDFW may authorize take if there is an approved habitat management plan or management agreement that avoids or compensates for impacts on listed species.

Impacts to listed species are evaluated in detail in Chapter 4. Implementation of the Manual Update would not result in the take of any species protected under CESA.

6.2.4 Natural Community Conservation Planning Act

Full Compliance

The Natural Community Conservation Planning Act (NCCPA), California Fish and Game Code, Section 2800, et seq., was enacted to form a basis for broad-based planning to provide for effective protection and conservation of the State's wildlife heritage, while continuing to allow appropriate development and growth. The purpose of natural community conservation planning is to sustain and restore those species and their habitat identified by CDFW that are necessary to maintain the continued viability of biological communities impacted by human changes to the landscape. A NCCP identifies and provides for those measures necessary to conserve and manage natural biological diversity within the plan area while allowing compatible use of the land. CDFW may authorize the take of any identified species, including listed and non-listed species, pursuant to Section 2835 of the NCCPA, if the conservation and management of such species is provided for in an NCCP approved by CDFW.

Implementation of the Manual Update is not anticipated to adversely impact any NCCP's.

6.2.5 California Water Code

Full Compliance

The preparation and adoption of water quality control plans, or Basin Plans, and statewide plans, is the responsibility of the SWRCB. State law requires that Basin Plans conform to the policies set forth in the California Water Code beginning with Section 13000 and any State policy for water quality control. These plans are required by the California Water Code (Section 13240) and supported by the Federal CWA. Section 303 of the CWA requires states to adopt water quality standards which "consist of the designated uses of the navigable waters involved and the water quality criteria for such waters based upon such uses." According to Section 13050 of the California Water Code, Basin Plans consist of a designation or establishment for the waters within a specified area of beneficial uses to be protected and water quality objectives to protect those uses. Adherence to Basin Plan water quality objectives protects continued beneficial uses of water bodies. Because beneficial uses, together with their corresponding water quality objectives, can be defined per Federal regulations as water quality standards, the Basin Plans are regulatory references for meeting the State and Federal requirements for water quality control (40 CFR 131.20).

The JFP is located within the jurisdiction of the Central Valley RWQCB, within the greater Sacramento Valley Watershed. In addition, because Folsom Dam is a part of the CVP, compliance with the Sacramento-San Joaquin Delta Basin Plan are also considered in this NEPA/CEQA document. The potential effects of the proposed project on water quality have been evaluated and are discussed in Chapter 4. The project is in compliance with the

Sacramento-San Joaquin Delta Basin Plan and no certifications from the Central Valley RWQCB are required.

6.2.6 California Register of Historic Resources

Full Compliance

The CRHR includes resources that are listed in or formally determined eligible for listing in the NRHP (see Chapter 19, Cultural Resources) as well as some California State Landmarks and Points of Historical Interest (PRC Section 5024.1, 14, CCR Section 4850). Properties of local significance that have been designated under a local preservation ordinance (local landmarks or landmark districts) or that have been identified in a local historical resources inventory may be eligible for listing in the CRHR and are presumed to be significant resources for purposes of CEQA unless a preponderance of evidence indicates otherwise (State CEQA Guidelines Section 15064.5[a] [2]). The eligibility criteria for listing in the CRHR are similar to those for NRHP listing but focus on the importance of the resources to California history and heritage. A cultural resource may be eligible for listing in the CRHR if it:

- is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage;
- is associated with the lives of persons important in our past;
- embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important individual, or possesses high artistic values; or
- has yielded, or may be likely to yield, information important in prehistory or history.

Impacts to eligible resources will be mitigated through the process outlined in the PA. CVFPB is a concurring party to the PA.

6.2.7 Native American Heritage Commission

Full Compliance

NAHC identifies and catalogs places of special religious or social significance to Native Americans and known graves and cemeteries of Native Americans on private lands, and performs other duties regarding the preservation and accessibility of sacred sites and burials and the disposition of Native American human remains and burial items. Consultation with NAHC, the Sacred Lands database, and Native American groups are discussed above under the National Historic Preservation Act section and also in Chapter 4.

6.2.8 Water Use Efficiency

Full Compliance

The California Constitution prohibits the waste or unreasonable use of water. Further, Water Code Section 275 directs DWR and the State Water Board to "take all appropriate proceedings or actions before executive, legislative, or judicial agencies to prevent waste or unreasonable use of water." Several legislative acts have been adopted to develop efficient use of water in the state:

- Urban Water Management Planning Act of 1985,
- Water Conservation in Landscaping Act of 1992,
- Agricultural Water Management Planning Act,
- Agricultural Water Suppliers Efficient Management Practices Act of 1990,
- Water Recycling Act of 1991, and
- Agricultural Water Conservation and Management Act of 1992.

The purpose of the proposed Manual Update is flood risk reduction and would not result in the waste or unreasonable use of water.

6.2.9 Public Trust Doctrine

Full Compliance

When planning and allocating water resources, the State of California is required to consider the public trust and preserve for the public interest the uses protected by the trust. The public trust doctrine embodies the principle that certain resources, including water, belong to all and, thus, are held in trust by the State for future generations.

In common law, the public trust doctrine protects navigation, commerce, and fisheries uses in navigable waterways. However, the courts have expanded the doctrine's application to include protecting tideland, wildlife, recreation, and other public trust resources in their natural state for recreational, ecological, and habitat purposes as they affect birds and marine life in navigable waters. The National Audubon Society v. Superior Court of Alpine County (1983) 33 Cal 3d 419 decision extended the public trust doctrine's limitations on private rights to appropriative water rights, and also ruled that longstanding water rights could be subject to reconsideration and could possibly be curtailed. The doctrine, however, generally requires the court and the State Water Board to perform a balancing test to weigh the potential value to society of a proposed or existing diversion against its impact on trust resources.

The 1986 Rancanelli decision applied the public trust doctrine to decisions by the State Water Board and held that this doctrine must be applied by the State Water Board in balancing all the competing interests in the uses of Bay-Delta waters (United States v. State Water Resources Control Board [1986] 182 Cal. App. 3d 82).

The proposed Manual Update is consistent with the public trust doctrine, as the primary goal includes improved flood risk management.

6.3 Local Laws

6.3.1 American River Parkway Plan

Full Compliance

The Flood Control Policies in the American River Parkway Plan (Sacramento County 2008) call for flood management agencies to maintain and improve the reliability of the existing public flood control system along the lower American River to meet the need to provide a high level of flood protection to the heavily urbanized floodplain along the lower American River consistent with other major urban areas.

The goal of water quality polices in the American River Parkway Plan is to ensure that water quality in the lower American River is maintained "to provide for beneficial uses of the river, including: municipal and domestic water supply; industrial service water supply; irrigation; water contact and non-contact recreation; freshwater habitat; migration of aquatic organisms; spawning, reproduction, and/or early development of fish; and wildlife habitat" (Sacramento County 2008).

Implementation of the Manual Update is not anticipated to impact the American River Parkway Plan.

6.3.2 Sacramento County General Plan

Full Compliance

Water resources policies contained in the Conservation Element of the Sacramento County General Plan are intended to provide direction regarding the conservation, development, and utilization of natural resources including water, soils, rivers, aquatic species and their habitats (Sacramento County 2011). Although the General Plan focuses primarily on urban development, its water quality protection policies, including erosion control and contaminants monitoring, ensure that the County will be able to provide a safe, reliable supply of quality water for its residents while protecting beneficial uses of waters of the State of California.

The Safety Element of the Sacramento County General Plan identifies and assesses the potential for hazards to occur in the County and to provide measures that adequately protect the public. Included in the Safety Element is the goal of minimizing the loss of life, injury, and property damage due to flood hazards. To achieve this goal, the element includes a policy of coordinating with the City of Sacramento, USACE, SAFCA, and other Federal, State, and local governments and agencies to develop a plan to finance and construct flood control improvement projects.

7.0 PUBLIC INVOLVEMENT AND INTERAGENCY COORDINATION

The Manual Update included a robust public outreach and interagency coordination program. In addition to the 30-day NEPA/CEQA public scoping process, a Stakeholder Engagement Plan was developed for the Manual Update based on seven discussion sessions that USACE, in partnership with Reclamation, SAFCA, and CVFPB/DWR, convened with the stakeholders (See *Stakeholder Situational Assessment Folsom Dam Water Control Manual Update,* 2013). Various stakeholder groups desired different levels of engagement in the Manual Update. As such, the Stakeholder Engagement Plan consisted of multiple venues for stakeholders to provide feedback on the Manual Update, further described in this chapter. All public involvement reports and documentation are included in Appendix G.

7.1 Public Scoping

A Notice of Preparation (NOP) of a Draft EIR was filed with the California State Clearinghouse on October 16, 2012 in accordance with CEQA requirements. Two public scoping meetings were held in the City of Sacramento and the City of Folsom during the 30-day scoping phase. Public notice of all scoping meetings were sent to the public, in addition to publication in newspapers and on the project and Partner websites. A Public Scoping Report was prepared to document the scoping process, comments received, and processing of comments for further consideration in the alternatives formulation and evaluation process. A mailing list for stakeholders and the public was develop and maintained. Although a Notice of Intent (NOI) to prepare a Draft EIS was filed with the Federal Register on October 16, 2012 as well, subsequent evaluations of effects indicated the proposed action would not result in significant effects on the human environment; therefore, compliance with NEPA is being pursued through preparation of this SEA and issuance of a Finding of No Significant Impact (FONSI).

7.2 Public Outreach Meetings

Starting in the fall of 2013 and continuing throughout the development of alternatives, USACE convened public outreach meetings quarterly. These meetings provided the venue for periodic policy and technical discussions on the Manual Update. The current project milestone calendar was distributed and discussed at each of these meetings. The meetings were publicly noticed, including invitations to the regional business community, emergency management and response agencies, lower Sacramento River and North Delta interests and other interested parties.

7.3 Project Partners Meetings

The USACE team met regularly with the partners at Task Force and Technical Focus Group meetings, which took place biweekly.

7.4 Governmental Stakeholders Meetings

Government stakeholders were invited to attend USACE's Technical Work Group and Environmental Effects Working Group on the Manual Update. Starting in June 2013, each of the Work Groups met quarterly.

7.5 Non-Governmental Stakeholders Meetings

SAFCA provided two venues for non-governmental stakeholders, as described in the bulleted section below. SAFCA was responsible to fully convey the perspectives, needs and issues expressed in these meetings to USACE, Reclamation and CVFPB/ DWR through official meetings on the Manual Update as well as through informal discussions with their project partners. The quarterly public outreach meetings provided a venue for the non-governmental stakeholders to have direct discussions with USACE, Reclamation and CVFPB/DWR.

- Lower American River Task Force: SAFCA provided briefings and discussions on the Manual Update at each of the quarterly Task Force meetings.
- More In-Depth Sessions for Non-Governmental Stakeholders: SAFCA held discussions to provide more extensive information on the Manual Update to interested non-government stakeholders.

7.6 Interagency Meetings

During the development of the updated WCM, coordination meetings have occurred as needed since 2011. The following agencies have been involved in interagency meetings throughout the development of the WCM and SEA/EIR: USACE; CVFPB; DWR; SAFCA; Reclamation.

7.7 Public Review and Comments on Draft SEA/EIR

Following completion of the Draft SEA/EIR, USACE and CVFPB filed a Notice of Completion with the State Clearinghouse to start the 45-day public review period. The public review began on June 7, 2017 and ended on July 21, 2017. A Notice of Availability was distributed to interested or affected agencies, groups, and individuals. Copies of the Draft SEA/EIR were furnished to those who specifically requested them and to agencies having jurisdictional responsibilities associated with the proposed action or its effects. Copies of the Draft SEA/EIR were also made available for download at the project website and for review at appropriate public libraries and offices. Public meetings were held on June 14, 2017 at the Sacramento City Library, and on June 15, 2017 at the Folsom Community Center, as required by NEPA, CEQA, and other laws and policies. Public notices were posted identifying the dates, times, and locations of the public meetings. All comments received were considered and incorporated in the Final SEA/EIR, as appropriate. The comments received and the responses to these comments are included in Appendix G. The CVFPB will consider certification of the Final SEA/EIR, adoption of the findings, and approval of the proposed project. At the time the CVFPB certifies the document, a Notice of Determination (NOD) will be signed. The NOD will be filed with the

State Clearinghouse within 5-business days of approval by CVFPB, starting a 35-day statute of limitations for legal challenges.

7.8 Document Recipients

7.8.1 Elected Officials and Representatives

County of Sacramento Board of Supervisors	El Dorado County, Board of Supervisors
Placer County, Board of Supervisors	Sacramento Area Council of Governments

7.8.2 Government Departments and Agencies

Calif. Dept. of Boating and Waterways	U.S. Bureau of Reclamation
CalEMA	U.S. EPA, Region IX
California Air Resources Board	U.S. Fish and Wildlife Service
California Department of Conservation	U.S. Fish and Wildlife Service
California Department of Fish and Game	U.S. Bureau of Reclamation, Mid-Pacific Region
California Department of Parks and Recreation	U.S. Coast Guard, 11th Coast Guard District
California Department of Transportation, District 3	U.S. Bureau of Land Management Central District Office, District Manager
California Natural Resources Agency	U.S. Fish and Wildlife Service, Ecological Services
California State Lands Commission	Department of Water Resources
Central Valley Flood Protection Board	County of El Dorado, Planning Services
County of Sacramento, Environmental Management	City of Folsom, City Council
County of Sacramento, Planning	City of Folsom, Public Works Department
County of Sacramento, Public Works	CDCR - Folsom State Prison
Department of Fish and Game, Region 2 Regional Manager	Office of Historic Preservation
Department of Parks and Recreation Folsom Lake State Recreation Area	Roseville Public Library
Federal Energy Regulatory Commission Office of Energy Projects	Regional Transit
Folsom Cordova Unified School District	SAFCA
Folsom Public Library	El Dorado County Library
National Marines Fisheries Service	El Dorado County DOT
Native American Heritage Commission	Sacramento Metropolitan Air Quality Management District
Natural Resources Conservation Service Elk Grove Service Center	Placer County Public Works
Placer County Community Development Resources Agency	Federal Emergency Management Agency

Regional Water Quality Control Board, Central Valley Region	State Water Resources Control Board: Division of Water Rights
Sacramento Central Library	City of Folsom, Community Development Dept.
San Juan Suburban Water District	Caltrans - District 3
Shingle Springs Band of Miwok Indians	El Dorado Irrigation District
Shingle Springs Band of Miwok Indians	Federal Highway Administration, Sacramento Office
State Water Resources Control Board, Division of Water Quality	City of Folsom
United Auburn Indian Community of the Auburn Rancheria	Western Area Power Administration
California Energy Commission	
Northern California Power Agency	

7.8.3 Private Organizations and Businesses

Aerojet, Environmental Operations	Folsom Ridge Homeowners Association
California Native Plant Society	Folsom Historical Society
Friends of the Folsom Powerhouse	Remy Thomas Moose & Manley LLP
Holderness Law Firm	Sacramento Local Area Formation Commission
Orangevale Neighborhood Library	Public Utilities Commission
Pacific Gas and Electric Company	Sacramento Audubon Society
Pinebrook Mobile Village	Sacramento Municipal Utility District
Save the American River Association	Parsons Brinckerhoff Quade & Douglas, Inc.
Sierra Club, Motherlode	El Dorado Hills Telegraph
Sutter Street Merchants Association	Folsom Telegraph
Environmental Council of Sacramento	Sacramento Bee

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